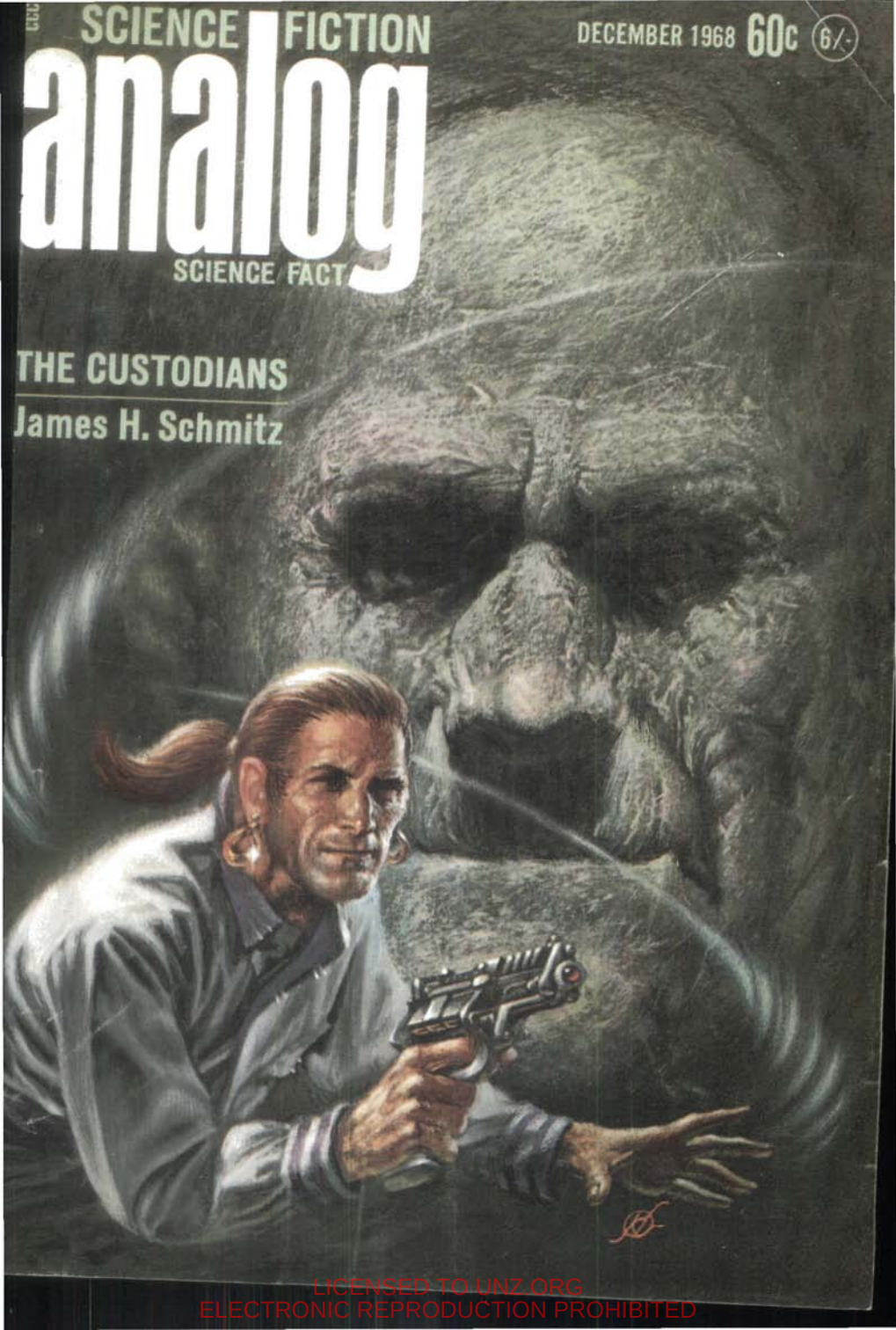

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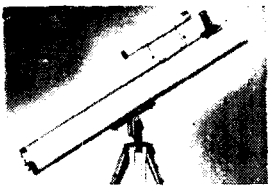

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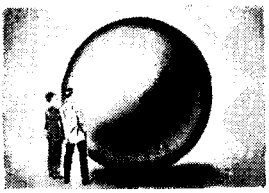

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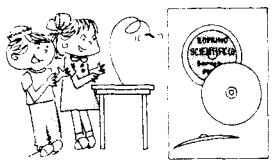

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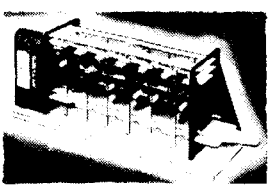

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analog

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NEXT ISSUE ON SALE
DECEMBER 5, 1968
$6.00 per year
in the U.S.A.
60 cents per copy

Cover by
Kelly Freas

Vol. LXXXII, No. 4 December, 1968

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Analog Science Fiction/Science Fact is published monthly by the Condé Nast Publications, Inc. Executive, Publishing, Editorial and Advertising offices: 420 Lexington Avenue, New York, N.Y. 10017. I.S.V. Patcevitch, President; Alfred W. Cook, Treasurer; Mary E. Campbell, Secretary. Second class postage paid at New York, N. Y. and at additional mailing offices, under the Act of March 3, 1879. Subscriptions: In U.S. possessions and Canada, $6 for one year, $10 for two years, $13 for three years. Elsewhere, $8 for one year, $16 for two years. Payable in advance. Single copies: In U.S. possessions and Canada, 60¢. For subscriptions, address changes and adjustments, write to Analog Science Fiction/Science Fact, Box 2205, Boulder, Colorado 80302. Six weeks are required for change of address. The editorial contents have not been published before, are protected by copyright and cannot be reprinted without the publisher's permission. All stories in this magazine are fiction. No actual persons are designated by name or character. Any similarity is coincidental. We cannot accept responsibility for unsolicited manuscripts or art work. Any material submitted must include return postage.

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Technological Status

editorial by John W. Campbell

It's been said that "Technology we can't understand appears to be magic." Actually, this applies only to technology more advanced than our own—for frequently we see some great technological device and, by familiarity, fail to recognize it for what it is.

Perhaps the Grade A #1 prime example is one which is now generally considered the perfect symbol of *non*-technology—the epitomization of the failure to develop technology.

The peasant-farmer, plodding along behind his horse-drawn plow as he sweats to till his fields does seem, to us, about as untechnical as you can get. Yet in that pastoral scene is a technical breakthrough that properly ranks slightly behind harnessing fire, and perhaps a bit ahead of the wheel. (After all, all the native American civilizations got along without the wheel!)

It might be described in modern terms as "a solid-state power-handling device for coupling a heavy duty power source to heavy tractive loads." Or, more simply, as the device that freed human slaves from service as draft animals.

One of the reasons the Romans and Greeks needed so many slaves was that there was no known way of harnessing animals to heavy draft loads. Man, because of his bipedal posture and his hands, could have a harness slipped over his chest and shoulders, and by leaning into it, exert all his strength in pulling the load. It was literally true that a man could exert more pull than a 1,500-pound horse.

A horse's sloping chest, and lack of shoulders or grasping hands, made it impossible to tie him to a load except by putting a rope around his neck. Do that, and as soon as he pulls, he's choked by the rope at his throat; he can pull only lightly before his wind is cut off and he has to stop. True, some powerful horses can exert enough pull to move a relatively light chariot at a good speed that way—but as a coupling device it's exceedingly inefficient. The horse couldn't pull a plow, or a heavy dray.

Oxen, equipped by Nature with some well-anchored horns, could do considerably better—but it was extremely tiring on even an ox's heavy neck muscles to hold his head down against the backward pull of the load.

The horse collar, invented somewhere, sometime during the Middle Ages in Europe, was Man's first really successful device for harnessing powerful animal muscles to do the heavy hauling work that was needed. It made possible heavy

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transport—even on the horrible mud ruts they called roads. It vastly increased the amount of agricultural land that could be prepared and used during a single growing season; there was far more food available for men and motive power. Where before horses and other animals had transported goods primarily as pack animals, transportation was expanded, quite suddenly, as greatly as it was a few centuries later with the invention of the steam-powered railroad.

Naturally, with the potential of heavy, relatively rapid transportation available, the sedan chair went out of use as the coach came in, and pack-trains were replaced by loaded wagons. Inevitably the demand for more roads wide enough —and good enough!—for horse drawn vehicles came, and the entire economy began speeding up.

The contact with the highly sophisticated and educated society of Islam was undoubtedly a tremendous factor in the development of the renaissance in the seacoast regions of the Mediterranean, where water transport made transportation reasonably effective. But it was the horse collar that brought an economic renaissance to most of Europe.

It's not at all easy to recognize technological importance—particularly when we're used to it. Certainly a horse collar seems a simple enough idea . . . .

Most moderns haven't actually seen and handled one, or studied one closely. Take a good look at the structure of a horse's chest and shoulders, and without studying a horse collar, try devising a form that will fit snugly onto those sloping curves and planes, allow the horse free movement of neck and forelegs, avoid concentrating load on prominent bony areas, and so distribute it that the horse can exert his full strength without painful chafing. Then make it stay in place without aid of adhesive tapes, glue, or surgical implants!

The agricultural technicians of the Middle Ages who developed that gadget were not fools, even if they hadn't ever had a course in mechanical engineering, or force-analysis. And they did achieve something that the learned Greeks, and the great Roman engineers did not; they harnessed the most effective power source in the world at the time.

And be it noted that that animal power source is still used as the basis for measuring our mechanical tractive engines—as Watt originally defined it in his sales-promotion literature for his new steam engines.

However, two horses can do a lot more plowing than a two-horsepower gasoline-engined tractor can; the gas job can't slow down in a tough spot, dig in its hooves, belly-down to the earth, and lunge with half a ton of hard-tensed muscle to drag the plow through.

Of course, the tractor is also not

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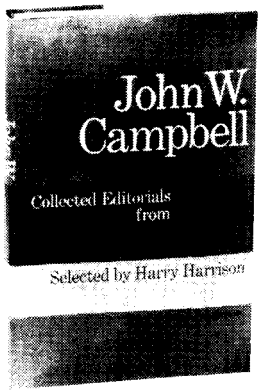

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capale of self-repair, automatic routine maintenance, living off the fields it works, self-replication, or sense enough not to destroy itself by ramming itself over a cliff. In addition to operating on locally-available fuels, a horse is approximately twice as efficient as a tractor *in conversion of chemical to mechanical energy.*

The moral of this little story is not to be applied just to humans visiting alien planets; it applies very cruelly to situations right here on our own crazy, confused world. Backward nations—I will not be euphemistic and call them "underdeveloped" because they've had the same thousands of years to develop that Europe and America had, and simply didn't do so—do not recognize the importance of what could be called "the Horse Collar Revolution."

Those economically depressed nations want, most ardently, to join "the modern world"—i.e., to achieve the industrially-developed status of the high level technological nations.

Now there are two kinds of "status"; one is what your neighbors think you are, and the other is what you actually have and can do. The first type of status is, of course, far and away the most popular, and the most eagerly sought.

One type of individual, if he hap-

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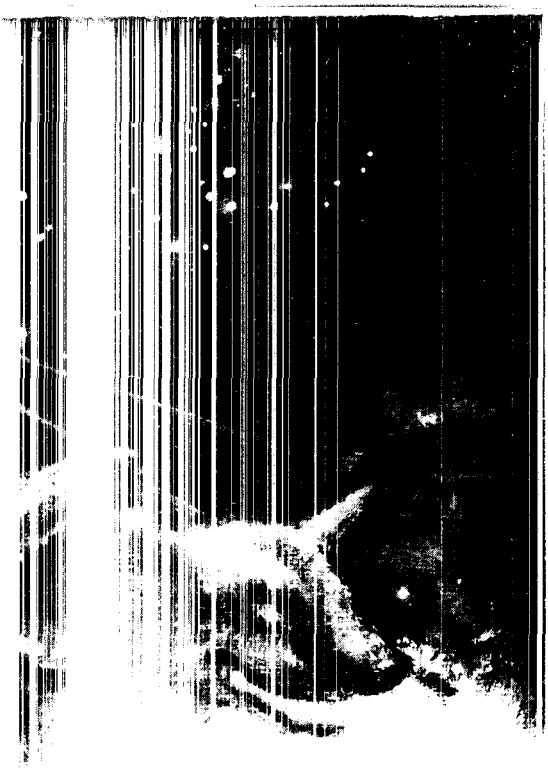

[illegible] when
I turn this terrible
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lover, alone in being a
flagged warrior . . .

L. SCHMITZ

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McNulty was a Rilf. He could pass for human if one didn't see him undressed; but much of the human appearance of the broad, waxy-pale face and big hands was the result of skillful surgery. Since the Rilf surgeons had only a vague notion of what humans considered good looks, the face wasn't pleasant, but it would do for business purposes. The other Rilf characteristic McNulty was obliged to disguise carefully was his odor—almost as disagreeable to human nostrils as the smell of humans was to him. Twice a day, therefore, he anointed himself with an effective deodorant. The human smells he put up with stoically.

Probably no sort of measures could have made him really attractive to humans. There was nothing too obviously wrong about his motions, but they weren't quite right either. He had an excellent command of English and spoke four other human languages well enough to make himself understood, but always with an underlying watery gurgle which brought something like a giant bullfrog to mind. To some people McNulty was alarming; to others he was repulsive. Not that he cared very much about such reactions. The humans with whom he dealt professionally were not significantly influenced by them.

To Jake Hiskey, for example, captain and owner of the spaceship *Prideful Sue* McNulty looked, sounded, and smelled like a million dollars. Which was approximately what he would be worth, if Hiskey managed things carefully for the next few days. Hence the skipper was smiling bemusedly as he poked the door buzzer of McNulty's cabin.

"Who is it?" the door speaker inquired in McNulty's sloppy voice.

"Jake. I've got news—good news!"

The lock snicked and the door swung open for Hiskey. As he stepped through, he saw another door at the far end of the cabin close abuptly. Beyond it were the living quarters of the other Rilf currently on the *Prideful Sue*, who went by the name of Barnes and whose olfactory sense was more seriously affronted by humans than McNulty's. Barnes might be second in command of McNulty's tribe of Rilf mercenaries, or possibly a female and McNulty's mate. Assuming that McNulty was male, which was by no means certain. Rilfs gave out very little information about themselves, and almost all that was known of their species was that it had a dilly of a natural weapon and a strong interest in acquiring human currency with which to purchase advanced products of human technology. Hence the weapon was hired out on a temporary basis to human groups who knew about it and could afford it.

"You will excuse Barnes," McNulty said, looking over at Hiskey

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from a table where he sat before a tapeviewer. "He is indisposed."

"Of course," said Hiskey. He added curiously, "What are you studying up on now?" McNulty and Barnes never missed an opportunity to gather information pertinent to their profession.

"Recent Earthplanet history," replied McNulty. "The past three years. I must say the overall situation looks most favorable!"

Hiskey grinned. "It sure does! For us . . ."

McNulty shut off the tapeviewer. "During the past two ship days," he remarked, "I have recorded news reports of forty-two of these so-called miniwars on the planet. Several others evidently are impending. Is that normal?"

"Actually it sounds like a fairly quiet period," Hiskey said. "But we might liven it up!" He pulled out a chair, sat down. "Of course I haven't been near Earthsystem for around eight years, and I haven't paid too much attention to what's been going on here. But on the planet it's obviously the same old stuff. It's been almost a century since the world government fizzled out: and the city states, the rural territories, the sea cities, the domes, the subterranes and what-not have been batting each other around ever since. They'll go on doing it for quite a while. Don't worry about that."

"I am not worrying," McNulty said. "The employment possibilities here appear almost unlimited, as you assured us they would be. What is this good news of which you spoke, Jake? Have your Earth contacts found a method of getting us down on the planet without further delay?"

"No," said Hiskey. "It will be at least five days before they have everything arranged. They're playing this very quietly. We don't want to alert anybody before you and your boys are set up and ready to go into action."

McNulty nodded. "I understand."

"Now here's what's happened," Hiskey went on. "This station we've stopped at is a branch of Space U. The navigator shuttled over to it half an hour ago to find out where he can get in touch with his sister. She's connected with Space U—a student, I suppose—and, of course, he hasn't seen her for the past eight years."

"She is what is known as a graduate student," said McNulty, who disliked vagueness. "Her name is Elisabeth and she is three Earth years younger than Gage. I heard him discuss the matter with you yesterday, and he mentioned those things specifically."

"I guess he did, at that," said Hiskey. "Anyway, he was told on the Space U station that she's a guest on a private asteroid at present, and he contacted her there by transmitter. The asteroid people offered to pick him up so he could

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spend a few days with his sister as their guest. Gage called me and I told him to say we'd deliver him to the asteroid's lock in the *Prideful Sue*, since we've got time to kill before we can get scheduled through the System check stations anyway. So that's been arranged. And when we get there, I'll see to it that I'm invited down to the asteroid with Gage."

"That is the good news?" McNulty asked blankly.

Hiskey grinned. "There's a little more to it than that. Did your tapes tell you anything about Earthsystem's asteroid estates?"

"Yes. They were mentioned briefly twice," McNulty said. "I gathered their inhabitants retain only tenuous connections with the planetary culture and do not engage in belligerent projects. I concluded that they were of no interest to us."

"Well, start getting interested," Hiskey told him. "Each of those asteroids is a little world to itself. They're completely independent of both Earthplanet and Earthsystem. They got an arrangement with Earthsystem which guarantees their independent status as long as they meet certain conditions. From what Gage's sister told him, the asteroid she's on is a kind of deluxe spacegoing ranch. It belongs to a Professor Alston . . . a handful of people, some fancy livestock, plenty of supplies."

"And what business could we have with such people?" inquired McNulty.

"I think they'll be useful. I told you the one thing that might bug our plans right now is to have the System Police get too curious about the *Prideful Sue* while we're hanging around here for the next five or six days."

"So you did," said McNulty. "And I now have a question about that. According to these tapes, Earthsystem has no jurisdiction over Earthplanet. Why then should the System Police attempt to control or investigate what Earth imports?"

Hiskey shrugged. "For my money they're busybodies. The SP got kicked off Earth for good something like forty years ago, but it still acts like it's responsible for what happens there. And it's got muscle enough to control the space of the system. Earth doesn't like that but can't do much about it. If the System Police got an idea of why we're bringing in a shipload of Rilfs to Earth, they'd never let us go down. As long as we do nothing to make them suspicious, they probably won't bother us—but we can't really count on it. However, if we move the *Prideful Sue* down beneath the force fields around Professor Alston's asteroid, she'll be out of sight and out of the SP's jurisdiction. By Earthsystem's own ruling, they *can't* bother us even if they have reason to think we're there."

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"You believe Professor Alston will permit you to land the ship?"

"No. I doubt he'd extend his hospitality that far. But it'll be difficult for him to avoid inviting me down for an hour or so, as Harold Gage's captain. When I mention we have a very interesting alien on board—first representative of his kind to reach Earthsystem, who has an intellectual curiosity about the human private asteroids—he'll invite *you* down. Half the crew can crowd into the skiff with you then and stay hidden in it till we want them."

McNulty gurgled interestedly. "You mentioned a handful of people—"

"From all I've heard, there'd be at most fifty even on a really big estate. Probably no more than half that. They don't like to be crowded on the asteroids—one reason most of them got off Earth to start with was that they wanted privacy and one place they could still buy it, if they had money enough, was in space."

"There should be then," said McNulty, "a most efficient and compact system of controls."

"You get the idea, McNulty. Those asteroids are set up like ships. That's what they've been turned into—big ships. Mostly they coast on solar orbit, but they can maneuver to some extent on their own."

"Then, as on a ship," McNulty continued, "the main controls will be concentrated for maximum efficiency within a limited area. It should take us at most an hour or two to gain a practical understanding of their use and operation."

"Might take you less than that," said Hiskey. Perhaps because of a congenital deficiency in inventive imagination, Rilf technology was at a primitive level as compared with the human one. But there was nothing wrong with their ability to learn, and McNulty, like most of them, was intensely interested in human gadgetry and very quick to grasp its function and principles. There wasn't much about the *Prideful Sue's* working innards he didn't know by now. "We needn't make any final decisions before you and I have checked the situation," Hiskey pointed out. "But it should be a cinch. We take over the control section, block the communication system, and we have the asteroid."

"That part of it may well be easy," McNulty agreed. "However, I would expect serious problems to follow."

"What kind of problems?"

"These asteroid people obviously do not isolate themselves completely from Earthsystem. They converse by transmitter. They receive guests. If these activities suddenly stop and no response is obtained from the asteroid, the Systems Police certainly should grow suspicious. With or without jurisdiction, they will investigate."

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Hiskey shook his head. "No, they won't, McNulty. That's what makes this easy for us."

"Please explain," said McNulty.

"A private asteroid—any private asteroid—is expected to go out of communication from time to time. They're one of Solar U's science projects. They seal their force field locks, shut off their transmitters; and when they open up again is entirely up to them. I've heard some have stayed incommunicado for up to ten years, and the minimum shutoff period's supposed to be not less than one month out of every year. What they're out to prove I don't know. But nobody's going to be upset if they discover suddenly that they're not able to get through to Professor Alston and his asteroid. They'll just settle back to wait until he's open to contact again."

McNulty reflected for a considerable time. "That does indeed sound like a favorable situation," he stated abruptly then. "Excuse us, Jake." He went on, without shifting his eyes from Hiskey's face, in the Rilf speech which sounded more like heavy sloshings of water than anything else. When he paused, Barnes's voice responded in kind from a wall speaker. The exchange continued for a minute or two. Then McNulty nodded ponderously at Hiskey.

"Barnes agrees that your plan is an excellent one, Jake. The elimination of the humans now in possession of the asteroid should present no great difficulty."

Hiskey looked startled. "I hadn't planned on killing them unless they try to give us a fight."

"Oh, but killing them is quite necessary," McNulty said.

"Why? We'll need the place only a few days."

"Jake, consider! On the ship which has trailed yours to Earth-system and is now stationed outside it beyond the patrol range of the System Police are fifty-five Rilfs and their equipment—our army. Four of them have been humanized in appearance as Barnes and I are. The others are obviously not human. The System Police must not be permitted to encounter them."

"Of course not," Hiskey agreed. "But if we're prepared to whisk them down to Earth as soon as they move into the system, the SP isn't going to have time to encounter them."

"I understand," McNulty said. "However, your plan gives us the opportunity to cover ourselves against any deceit or treachery which might be considered by our Earth employers. With perhaps a third of our army left waiting in space, prepared to act, nobody will attempt to renege on contracted payments. And where could a better concealed base be found for our reserve and their ship than such an asteroid, only a few hours from

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Earth? And we can't afford to have prisoners on that base who would have to be constantly and closely guarded to make sure they cause no trouble. There is too much at stake."

Hiskey said slowly, "Yeah. I guess I see your point."

"Nor," continued McNulty, "can we destroy some and spare others. A single surviving witness might become most inconvenient eventually. Therefore, we must also kill Gage's sister. Since Gage will make a great deal of money as a participant in our operation, he may not object too strongly to that."

Hiskey stared at him for a moment

"Some things you just don't get, McNulty," he remarked. "Harold Gage is going to object like hell to having his sister killed!"

"He will? Well, I must accept your opinion on the point," said McNulty. "It follows then—"

"I know. We'd have had to get rid of Gage anyway. He wouldn't go along with taking over the asteroid even if his sister weren't there and it wasn't a killing job. We were friends once, but he's been giving me a lot of trouble like that. Now we're in Earthsystem, we don't need a navigator. He goes with the asteroid people."

"That will not cause trouble among your men?"

Hiskey shook his head. "He hasn't had a friend on board for the past two years. We needed him, that's all. If he's eliminated, everybody gets that much better a split. There'll be no trouble."

"I'd gained the impression," McNulty observed, "that he was a rather dangerous person."

"He's a bad boy to go up against with a gun," Hiskey said. "But he won't be wearing guns on a friendly visit to a private asteroid, will he? No, you needn't worry about Gage."

McNulty said he was glad to hear it. He added, "There is, incidentally, an additional advantage to disposing of the asteroid humans. Before I demonstrate the toziens to our prospective employers, they should be exercised. At present, after their long idleness on shipboard, they have become sluggish."

Hiskey grimaced. "I thought those things were always ready to go."

"No. Permit me." McNulty reached into the front of his coat, paused with his hand just out of sight, made an abrupt shrugging motion. For an instant there was a glassy glittering in the opening of the coat. Then it was gone, and something moved with a hard droning sound along the walls of the cabin behind Hiskey. He sat very still, not breathing, feeling blood drain slowly from his face.

"Do not be disturbed, Jake," said McNulty. "The drug I give you and your crew makes you as immune as a Rilf to the toziens'

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killing reaction." He lifted his hand. "Ah, now! It becomes conditioned. It adjusts! We no longer hear it."

The drone was thinning to a whisper; and as McNulty stopped speaking, there was a sudden complete silence. But the unseen thing still moved about the cabin. Hiskey felt abrupt brief stirrings of air to right and left of his face, as if the tozien were inspecting him; and in spite of McNulty's assurance he sat frozen and rigid.

"Well, enough of this," McNulty said. Hiskey didn't know what means the Rilf had of summoning the tozien back to him, but for a moment he saw it motionless on the front of McNulty's coat, a clinging glassy patch about the size of a man's hand. Then it disappeared beneath the coat and McNulty closed the coat, and Hiskey breathed again.

"That illustrates my point," McNulty told him. "The tozien remained audible while I might have counted to twenty, slowly. They are all like that now."

Hiskey wiped his forehead. "If they adjust in a few seconds, I can't see it makes much practical difference."

McNulty shook his head reprovingly.

"Those few seconds might give someone time to be warned, find shelter, and escape, Jake! In a tozien attack there should be no escape for foreign life which is not already behind thick walls or enclosed in strong armor. That is the beauty of it! On my last contract I was in a crowd of alert armed men when I released my toziens. In an instant the air was full of a thousand invisible silent knives, striking simultaneously. Some of the humans gasped as they died, but there were no screams. A clean piece of work! That is how it must be when we demonstrate the toziens to our Earth employers. And since I will be the demonstrator, I shall blood my swarm on the asteroid, on its humans and their livestock, and then they will be ready again."

"Well, that part of it is your business," Hiskey said, rather shakily.

Along the perennial solar orbit it shared with Earthplanet, the Alston asteroid soared serenely through space. Earth was never visible from the asteroid because the sun remained between them. The asteroid's inhabitants had no regrets about that; they were satisfied with what they could see, as they might be. The surface of what had been a ragged chunk of metal and mineral had been turned into an unobtrusively cultivated great garden. The outer atmosphere was only two hundred yards thick, held in by a shell of multiple force fields; but looking up, one would have found it difficult to say how it differed from the day and night skies of Earth. Breezes blew and clouds

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drifted; and a rainfall could be had on order. And if clouds, breezes, sky blueness and rainfall weren't entirely natural phenomena, who cared? Or, at least, cared very much . . .

It had cost a great deal of money initially to bring the asteroid over from the Belt and install the machines which transformed its surface into a facsimile section of Earth, planted Earth gravity at its core, set it on Earth's orbit and gave it measured momentum and a twenty-four hour spin. It cost considerably more money to bring in soil, selected plants, selected animals, along with all the other appurtenances of enclosed but very comfortable and purposeful human habitation and activity. But once everything had been set up, it cost nothing to keep the asteroid going. It was self-powered, very nearly self-maintaining and self-sustaining. A variety of botanical projects initiated by Professor Derek Alston, its present owner, incidentally produced crops of spices disposed of in Earthsystem, which more than covered current expenses.

On this morning Derek Alston sat cross-legged by the side of a miniature lake, listening to and sometimes taking part in the conversation between his wife Sally and Sally's friend, Elisabeth Gage. Sally was a slightly tousled bronze blonde and Elisabeth had straight long jet-black hair sweeping about her shoulders, but Derek kept noticing points of resemblance between the two, in structure, motions and mannerisms, almost as if they had been rather closely related, say first cousins. Though they were, Derek thought, in fact simply two excellent examples of the type of tall comely young women Earthsystem seemed to produce in increasing numbers each year. They had been fellow students at Solar U before Sally's marriage a little less than a year ago now, and, until Elisabeth arrived yesterday at the asteroid they hadn't met in person since then. From what Sally had told him, Derek already knew a good deal about Elisabeth before he saw her.

The talk, naturally, mainly was about Elisabeth's brother who should reach the asteroid in another hour or so. There was, Derek knew, in what was being said and in what was not being said between these two, a trace of awkwardness and uncertainty. Essentially, of course, it was an occasion for festivities and rejoicing. Elisabeth was happy. There was no question about that. Her face was filled with her reflections . . . dreamy dazed smiles, cheeks glowing, eyes brimming briefly now and then. Her brother was the only surviving member of her family, and they'd been very close throughout her childhood. And now there'd been eight years of separation, and she hadn't known until

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Harold called that he'd come back to Earthsystem, or was even planning to come back. She'd had no reason to expect him. So she was happy, melting in happiness in fact. And Sally shared sympathetically in her friend's feelings.

But there was the other side to this matter. It wasn't to be mentioned now, but it couldn't be dismissed either . . .

"His voice hasn't changed at all —" Elizabeth had just said. There was a tiny silence then, because she had touched, inadvertently, the other side of the matter, and it seemed to Derek the right moment to speak.

"Only twenty-eight years old" he remarked. "Your brother's very young to have put eight years of outsystem travel behind him."

Elisabeth looked at him a moment and smiled. "Yes, I suppose he is," she said. "He was just twenty when he was graduated from navigation school at the SP Academy. Dad was with the SP in Mars Underground, and I know he thought Harold would stay with the force. But after Dad died, Earthsystem looked too tame to Harold. He wanted real adventure and he wanted to make his fortune. Captain Hiskey was putting together his crew just then, and Harold signed as navigator. The pay wasn't much, but the crew was to share in ship's profits." She gave a small shrug. "I'm afraid Harold hasn't made his fortune yet, but he's certainly had adventures. Even from the little he's told me, I know the ship often must have been doing very risky work."

"What were Captain Hiskey's qualifications for that kind of work —for outsystem commerce generally?" Derek asked.

Elisabeth's eyes flickered. "Harold said Hiskey had been first officer on a big transsolar transport. Then he got money enough to buy his own ship." She hesitated. "I guess they've tried about anything they could. But they never had a good enough streak of luck to do much better than break even . . . or else they'd get good luck mixed up with bad. Perhaps Harold will stay in Earthsystem now. But I have a feeling he won't. He was always very stubborn when he set himself a goal."

"You heard from him regularly?"

"No, not regularly. Not very often either. I've had seven message-packs from him in eight years. Somebody would get back to Earthsystem and drop the pack off at Mars Underground or Solar U, and I'd receive it that way. The last one was just six months ago. It didn't say a word about the ship coming back. That's why I can still hardly believe Harold's here."

The eyes had begun to brim again. Sally said quickly, "Perhaps he wasn't sure he'd be coming

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back and didn't want to build up your hopes."

Elisabeth nodded. "I suppose that was it. And . . ."

Derek drew back mentally from what she was saying. An independent outsystem trader—not a very large ship, from what Elisabeth had told them. A crew working mainly on a gamble, willing to try anything, each man out to make his fortune, hit the big money by some means. At least some of the men on Captain Hiskey's ship had pursued that objective for eight years without getting there.

Man played it dirty and rough on Earth, held back only by a few general rules which none dared break. In the outsystems the same games were played, as extensions of those on Earth, perhaps somewhat dirtier and rougher, with no enforceable rules of any kind. Drop an adventurous, eager twenty-year-old into that kind of thing after the quiet order of Mars Underground, the disciplines of the SP Academy . . . well, it might shape the twenty-year-old in one way or another, but shape him it would, thoroughly and fast, if he was to survive. Eight years should have worked quite a few changes in Harold Gage. The changes needn't have been evident in the message-packs Elisabeth had received. But she was intelligent, and she knew in general what the outsystems were like. And so, unwillingly, she was apprehensive of what she would find in her brother.

It bothered Derek because he liked Elisabeth and thought that whatever her expectations were, she might still be in for a shock. He checked his watch, got to his feet, smiled at his wife and guest and excused himself. A few minutes later, seated at a transmitter, he dialed a number.

"Lieutenant Pierce," a voice said. "Who is calling?"

"This is Derek Alston, Mike."

"And what can the System Police do for Professor Alston today?" asked Michael Pierce.

"Do you have anything on an outsystem tramp trader called *Prideful Sue?* Captain-owner's name is Hiskey. He might have checked in a day or two ago."

"Hold on," Pierce told him.

Perhaps a minute passed before his voice resumed. "There's a ship by that name and of that description in the territory, Derek. She's Earthplanet registry. Last SP check was ten years ago. No record of present owners. First reported as having arrived from transsolar three days ago. We have a mild interest in the ship because the captain evidently has no intention of checking in or going through Customs. Of course, an SP check isn't compulsory if his business is only and directly with Earthplanet and if we have no reason to suspect Class A contraband.

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However he keeps shifting about the system as if he preferred to keep out of our way. Do you feel we should give him more attention?"

"I have no definite reason to think so," Derek said. "But possibly you should."

A number of things were disturbing Harold Gage. One of them was that Jake Hiskey had invited himself down on the asteroid with him. Jake had made no mention of such plans until the *Prideful Sue* eased in to a stop on the coordinates given them in the Alston asteroid's gravity field and went on space anchor. Then Harold came forward to the comm room; and there was Jake, freshly shaved and in dress uniform, talking to the Alstons on viz screen. The matter was already settled. How Jake wrangled the invitation Harold didn't know, but he was downright charming when he wanted to be; and undoubtedly he'd made the Alstons feel it would be impossibly rude not to include him in the party. Jake switched off the screen, looked at Harold's face and grinned.

"Hell, Harold," he said. "You're not begrudging an old friend a few hours' look at sheer luxury, are you?"

"No," Harold said. "But in this case I felt I was already imposing on Elisabeth's friends."

"Ah—don't be so sensitive. They invited you, didn't they? And Professor Alston and that sweet-looking wife of his will get a boot out of me. These millionaire hermits must get mighty bored on their pretty-pretty asteroids where nothing ever happens. We're transsolar spacers, man! We've been places and done things it would curl their hair to think about. We're romantic!" He clapped Harold on the shoulder. "Come on! They told me your sister's waiting at the lock. Hey, this is one place we don't have to wear guns when we stick our noses outside—seems odd, doesn't it?"

And then they were down; and there, first of all, was Elisabeth —not a girl any more but, startlingly, a beautiful woman. Harold wasn't even sure he would have recognized her if she hadn't run towards him, laughing and crying a little, as he stepped out of the skiff, and clung to him for long seconds. And there were the Alstons, pleasant people who immediately took Jake in hand and smoothly dissociated him and themselves from the Gages, so that in only minutes Harold and Elisabeth were wandering about alone in this sunlit, rather dreamlike garden of an asteroid.

He'd been afraid there'd be an awkwardness between them, but none developed. Elisabeth was a completely honest person, of the kind whose expression hides nothing because there is rarely anything in their minds they want to

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hide. She studied him frankly and gravely, his eyes, his mouth, his motions, listened to his voice and its inflections, her face telling him meanwhile that she realized he'd changed and something of the manner in which he'd changed, and that she was accepting it, perhaps with regret but without judgment and with no loss of affection. He knew, too, that this was a matter it wouldn't be necessary to talk about, now or later . . . later meaning after the business on Earthplanet was concluded. What was left then was that he always would have to be a little careful of what he said to her, careful not to reveal too much. Because what Elisabeth didn't know, couldn't possibly know, was just how extensive the change had been.

He told himself it couldn't have been helped. In the outsystems it could hardly have worked out otherwise. For a while they'd remained fairly selective about what they did with the *Prideful Sue*. If a job looked too raw, they didn't touch it. But they weren't making money, or not enough, and the raw jobs began to look less unacceptable. Then some of the crew dropped out, and some got killed, and the replacements were outsystem boys with outsystem ideas. On occasion they'd come close to straight raiding then; and if it had been up to Jake Hiskey alone, what difference was left finally mightn't have mattered enough to count. But a first-class navigator was the most valuable man on the ship in the outsystems; and Harold was a first-class navigator by then. If he hadn't been one, he still would have been the most valuable man on the *Prideful Sue;* Hiskey had come to depend on him more and more. So he could put a stop to an operation if it looked too bad, and from time to time he did. It didn't get him liked on board; but, as it happened, he'd also developed a first-class gun hand. If necessary the hand might get a little more blood on it, and Navigator Gage would get his way.

This last move now, the big one, the one which was to make the whole past eight years pay off extremely well, importing McNulty's mercenaries and their devastating weapon, the Rilf toziens, to Earthplanet—he'd thought about it long and hard and had been at the point of backing out more than once. Hiskey, whose idea it had been, argued that it was a perfectly legitimate enterprise. It was, without question. Earthplanet's criterion of permissible weaponry was the guaranteed limitation of effect. A tozien strike had an active period of less than two days, a target radius of less than twenty miles. It fell well within the allowable range.

And it would have the value of a completely unexpected innovation. Earthplanet hadn't yet heard of the Rilfs. Hiskey had contacts

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who knew how to handle this kind of thing to best advantage all around. Everyone involved would share in the cut, and the cut was going to be a very large one. Of course, after the first dozen mini-wars came to an abrupt end, that part of it would be over. McNulty would be in general demand and could get along without middlemen. There'd be no further pay-offs to the crew of the *Prideful Sue*. But down to the last man on board, they'd be more than wealthy enough to retire.

It was, Jake Hiskey pointed out, no more of a dirty business, if one wanted to call it that, than other operations they'd carried out. The Earth gangs periodically slaughtered one another, and there was very little to choose between them. What great difference did it make to hand some of them a new weapon?

It wasn't much of an argument, but what decided Harold was that this was Jake Hiskey's last chance and that Jake knew it and was desperate. He was fifteen years older than Harold and looked a decade older than that. The outsystems had leached his nerve from him at last. If Harold pulled out, Hiskey wouldn't be able to handle the deal with the Rilfs, wouldn't be able to work a troop of them back to Earthsystem. He was no longer capable of it. And when one had flown and fought a ship for eight years with a man, had backed him and been backed by him in tight spots enough to do for a lifetime, it was difficult to turn away from him when he was finished. So all right, Harold had thought finally, one more play, dirty as it might be. Then he and Jake could split. There was nothing really left of their friendship; that had eroded along the line. If the SP didn't manage to block them, they'd get the Rilfs to Earth. Afterwards they couldn't be touched by Earthsystem, even if it became known what role they'd played. They'd have done nothing illegal.

And he could hope the role they'd played wouldn't become known. He'd told Elisabeth the *Prideful Sue* had returned to Earthsystem on very big and very hush-hush business, something he wasn't free to talk about, and that if the deal was concluded successfully he might be taking a long vacation from spacefaring. She seemed delighted with that and didn't ask for details, and Harold inquired what she'd been doing these eight years, because none of the message-packs she'd sent ever had caught up with him, and soon Elisabeth was talking and laughing freely and easily. For a short while, the past years seemed almost to fade. as if they were strolling about a park in Mars Underground rather than on this fabulous garden asteroid where handsome horned beasts stepped out now and then

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from among the trees to gaze placidly at them as they went by . . .

"Mr. Gage! Elisabeth!"

He stopped, blinking. It was like an optical illusion. There was a steep smooth cliff of rock to the left of the path they were following; and in it, suddenly, an opening had appeared, a doorway, and Sally Alston had stepped out of it and was coming towards them, smiling. "I looked for you in the scanners," she told Elisabeth. Then she turned to Harold. "Mr. Gage, why didn't you let us know you had this extraordinary alien person on board? If Captain Hiskey hadn't mentioned—"

"Alien person?" Elisabeth interrupted.

"Why, yes! Somebody called a Rilf. Derek is certain Solar U has no record of the species, and Captain Hiskey and Mr. Gage are taking him to Earthplanet on a commercial mission for his people. It's really an historical event!"

Harold stared at her, completely dumbfounded. Had Jake gone out of his mind to mention McNulty and the Rilfs to the Alstons? Elisabeth gave him a quick glance which asked whether this was the big hush-hush business he'd been talking about.

"He's even given himself a human name," Sally told Elisabeth. "McNulty!" She smiled at Harold. "I must admit I find him a little shivery!"

"He's here?" Harold heard himself saying. "McNulty's *here,* on the asteroid?"

"Of course! We invited him down. When Captain Hiskey—"

"How long's he been here?"

She looked at him, startled by his tone. "Why, about twenty minutes. Why?"

"No," Harold said. "Don't ask questions." He took each of them by an arm, began to walk them quickly towards the opening in the cliff. "Do you know exactly where McNulty is at the moment?"

"Well, they—my husband and Captain Hiskey and McNulty—probably are in the control room now. McNulty was saying how interested he'd be in seeing how the asteroid was operated."

That tied it. "You didn't send up for him?" Harold asked. "The ship's skiff brought him down?"

"Yes, it did. But what is the matter, Mr. Gage? Is—"

"And the skiff's still here?" Harold said. "It's inside the field lock?"

"I suppose so. I don't know."

"All right," Harold said. He stopped before the opening. "Now listen carefully because we're not likely to have much time!" He drew a quick deep breath. "First, where is the control room?"

"In the building in the space lock section," Sally said. "The administration building. You saw it when you came down." They were watching him, expressions puzzled and alarmed.

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Harold nodded. "Yes, I remember. Now—you and everyone else on the asteroid is in very serious danger. McNulty is a real horror. He has a special weapon. The only way you can stay reasonably safe from it is to hide out behind good solid locked doors. I hope you'll have some way of warning Professor Alston and whoever else is around to do the same thing. Anyone who's in the open, isn't behind walls, when McNulty cuts loose won't have a chance. Not for a moment! Unless he belongs to the *Prideful Sue's* crew. If you can get to a transmitter in the next few minutes, call the SP and tell them to come here and get in any way they can—in space armor. But transmitters aren't going to stay operable very long. You'll have to hurry." He looked at their whitened faces. "Don't think I'm crazy! The only reason Hiskey would have told you about McNulty, and the only reason McNulty would have showed himself, is that they've decided between them to take over the place."

"But why?" cried Sally.

"Because we're the next thing to lousy pirates. Because they think they can use this asteroid." Harold started to turn away. "Now get inside, seal that door tight, move fast, and with luck you'll stay alive."

So this was one place guns wouldn't be needed! In mentioning that, Jake Hiskey had made sure his navigator wouldn't—quite out of habit and absentmindedly—be going down armed to the peaceful Alston asteroid and to the reunion with his sister. He knew this was a job I couldn't buy, Harold thought. Even if Elisabeth hadn't been involved—

He'd set off at a long lope as soon as the camouflaged door in the cliff snapped shut. The asteroid surface in this area was simulated hilly ground, slopes rising and dipping, occasional smooth slabs of meteorite rock showing through. Clusters of trees, shrubbery, cultivated grassy ground . . . The space lock section couldn't be more than a few hundred yards away, but he couldn't see it from here. Neither could anyone in the open see him approaching. Sally Alston had said she'd located them by using scanners. Hiskey and McNulty could spot him by the same means, but they wouldn't be looking for him before they'd secured the control room. Standard raiding procedure . . . hit the nerve center of an installation as quickly as possible; take it, and the rest is paralyzed, helpless, silenced.

He checked an instant. A curious sensation, like a vibrating pressure on his eardrums, a tingling all through his nerves; it continued a few seconds, faded, returned, faded again . . . and the herd came suddenly around the side of the hill ahead of him. Some fifteen large

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gray-brown animals, a kind of antelope with thick corkscrew horns, running hard and fast. In the moment he saw them, startled, he took it for an indication that McNulty had released the toziens—and knew immediately it wasn't that. Nothing ran from toziens; there was no time. The herd crossed his path with a rapid drumming of hoofs, pounded through thickets, wheeled and appeared about to slam head-on into a vertical cliff wall. At the last moment an opening was there in the rock, similar to the one out of which Sally Alston had stepped, five or six times as wide. The beasts plunged through it, shouldering and jostling one another, and the opening vanished behind the last of them.

It all seemed to have happened in an instant. He ran on, wondering. That odd sensation, switching on and off—an alert signal? An alarm to which even the animals here were conditioned to respond immediately, in a predetermined manner, a "take cover!" that cleared the surface level of anything capable of reacting to it in moments . . . it indicated a degree of efficiency and preparedness he wouldn't have attributed to these asteroid dwellers. What sort of emergencies could they expect here?

He saw no more fleeing beasts, or any beasts at all; and in perhaps another minute the tingling irritation in his nerves had ended. The space-lock section couldn't be far away. He'd been cutting across the slopes, avoiding the leisurely winding and intersecting paths along which he'd come with Elisabeth, and keeping to cover when it didn't slow him down. At last then, coming out of a grove of trees on the crest of one of the little hills, he saw the administration building ahead—or rather one corner of it, warm brown, edged with gleaming black, the rest concealed behind trees. There was no one in sight, but he moved cautiously now, staying within the shrubbery. A hundred feet on, he came to a point which overlooked the landing area beneath the space lock. The *Prideful Sue's* skiff stood in the center of the area, entry port open. Otherwise the section looked deserted.

Above the skiff nothing showed but the simulated Earth sky. If the space lock through the energy carriers englobing the asteroid had been activated, it would have been visible—a ring of frozen fire from below, a glowing cylinder from where Harold stood, the cylinder's thickness depending on the degree to which the lock was expanded. Undoubtedly it could be expanded enough to let in the *Prideful Sue*, and undoubtedly Hiskey had just that in mind. But whatever else he might have accomplished so far, he hadn't yet got around to bringing down the ship.

The skiff wasn't large, but eight

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or nine men with raiding gear—about half the crew—could have been crammed in with McNulty and left waiting in concealment until they received Hiskey's signal to emerge and go into action. The open entry lock indicated they'd already received the signal, were now inside the administration building. In other words, at some point within the past few minutes the attack on the asteroid had begun. Barnes, the second Rilf, and the rest of the crew were still on the ship. If they joined the group on the asteroid, the situation might become nearly hopeless. As things stood, it seemed quite bad enough, but at least there'd been no sign as yet of the Rilf toziens. It was possible that if Jake Hiskey met no significant resistance from Alston's people, he would prefer not to turn this into a killing operation.

But he'll want to get me in any case, Harold thought. To keep me from interfering . . .

They hadn't had time to try to locate him with scanners, but somebody might have been posted outside the administration building to ambush him if he showed up here. The most likely spot for a watcher seemed the cluster of trees and bushes which screened the building—

A blue and golden bird twice the size of a pigeon burst out of the undergrowth six feet ahead and launched itself upwards with a strong beat of wings. Startled—that might easily have advertised his approach—Harold dropped to a deep crouch, glancing after the bird. It rose swiftly to a point about thirty feet above the ground. There something struck and destroyed it.

It seemed as abrupt as an explosion. The flying shape changed to sprays of blood and colorful ribbons and rags which were slashed and scattered again and again in the same instant, then left to fall back to earth. So it was a killing operation after all and McNulty had turned loose his toziens. Not, of course, all of them. There were thousands packed away in his thick nonhuman thorax; and only a small fraction of that number were required to sweep the surface of the asteroid and any sections of the interior open to intrusion clear of animal life large enough to attract their attention. They could have been released only moments ago or he would have been made aware of their presence—as he was aware of it now. An eerie whispering about him, now here, now there, as the toziens darted down in turn in their invisible speed towards this living flesh, sensed the Rilf drug which protected him as it protected all those who manned the *Prideful Sue*, and swerved away. But everyone else on the asteroid who had not found shelter had died or was dying in these seconds.

Starting forwards again, he shut that thought away. Jake Hiskey

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and McNulty, having begun the slaughter, would finish it. They'd be in the control room at present, securing their hold on the asteroid. That done, they'd bring in the ship and start looking for holed-up survivors.

The man Hiskey had selected to act as lookout at the building was Tom Connick. Not the brightest, but an excellent shot and normally steady as a rock—a good choice as an assassin. He stood, screened by a thicket, thirty feet from what seemed to be the only entrance into the building, a gun ready in his hand. They knew Harold wasn't armed; and if he wanted to get into the administration building, he'd have to come past the thicket, within easy range for Connick. It must have seemed as simple as that.

McNulty's toziens, however, had provided a complication. Connick's usual calm was not in evidence. He kept making small abrupt motions, bobbing his head, flinching right or left, jerking up the gun and putting it down again. Harold could appreciate his feelings. He, too, was still drawing the interest of the invisible swarm; every few seconds there would be a momentary indication that a tozien was nearby, and each time his flesh crawled though he knew, as Connick did, that theoretically they were protected from the little horrors. The thought remained that some tozien or other might not realize in time that they were protected. But at present that was all to his advantage. Connick darted glances this way and that, now and then half turning to see what was in back of him; but he was looking for the wrong kind of danger. So in the end Harold rose up quietly from the undergrowth ten steps behind Connick with a sizable rock in either hand.

He lobbed the left-hand rock gently upwards. It lifted in a steep arc above Connick's head and came down in front of him. And, for a moment, Connick's nerves snapped. He uttered a frightened sound, a stifled squeal, jabbed the gun forward, shoulders hunching, attention frozen by the deadly dark moving thing which had appeared out of nowhere. It was doubtful whether he even heard the brief rustle of the thicket as Harold came up behind him. Then the edge of the second rock smashed through his skull.

And now there was a gun for Harold, and for Jake Hiskey one man less he might presently send out to look for surviving asteroid people. Harold found a recharger for the gun in one of Connick's pockets. There'd been some question in his mind whether there mightn't be a second man around, though he had studied the vicinity thoroughly before moving in on Connick. But nothing stirred, so Connick's death had not been ob-

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served. He could expect to find somebody else stationed inside the building entrance, as a standard precaution.

He started quickly towards the building, then checked. On the far side of the space-lock area there was a faint greenish shimmering in the air, which hadn't been there before. Harold stared at it sharply, looked around. Behind him, too, much closer, barely a hundred feet away--like a nearly invisible curtain hanging from the simulated sky, fitted against the irregularities of the ground below. He pointed Connick's gun into the air, triggered it for an instant. There was a momentary puff of brightness as the charge hit the immaterial curtain. More distantly to the right, and, beyond the administration building to the left, was the same shimmering aerial effect.

Energy screens. Activated within the past few minutes. By whom? They enclosed the space-lock section, boxed it in. If they'd been thrown up before the tozien swarm appeared in the section, then McNulty's weapon was still confined here unless it had found an entry to the asteroid's interior from within the building. And the screens might have gone up just in time to do that; he'd been too involved in his wary approach to the building area to have noticed what happened behind him. There was suddenly some real reason for hope . . . because this fitted in with the silently pervasive alert signal which had come so quickly after his warning to Sally Alston, with concealed doors opening and closing on the surface and animals streaming off it into the interior. The asteroid had defenses, and somebody was using them—which did not make it any less urgent to do something about the *Prideful Sue's* crew and its Rilf allies before the defenses were broken down.

There was someone waiting inside the entrance. It was Dionisio.

"What's slowing you men down in there, Dionisio?" Navigator Gage demanded curtly, striding towards him. "Why aren't you moving?"

Dionisio was considerably more intelligent than Connick, but, besides being also badly fretted by the toziens, he was, for a moment, confused. He'd been told the navigator was among those to get it here; but he'd also been told that the navigator was unarmed and had no idea of what was going to happen. And here the navigator came walking up, casually holding a gun at half-ready, looking annoyed and impatient, which was standard for him on an operation, and sounding as if he were very much in on the deal. And, of course, there was the further consideration that the navigator was an extremely fast and accurate man with a gun. So Dionisio blinked, licked his lips, cleared his

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throat, finally began, "Well . . . uh—"

"The skipper's got the control room cleaned up?"

"Well, sir, I guess so."

"You *guess* so?"

"I wasn't there," Dionisio said sullenly, eyes fixed with some nervousness on the gun Navigator Gage was waving around rather freely. "I was in the skiff. There was that funny feeling we all got. Right after that we got the skipper's signal. So we came out. The skipper tells us to start looking around for the people."

"The people in the building?"

"Uh-huh. The skipper and McNulty were in the control room. There were five, six of the people here with them. And then the skipper looks around, and there's *nobody* there."

The navigator's lip curled. "You're implying they disappeared? Just like that?"

"Looks like it," said Dionisio warily.

"Everybody in the building?"

"Uh-huh."

"So what are they doing in there now?"

"Blowing in the walls. Looking for, uh, doors."

"Looking for doors!" repeated Navigator Gage, total disgust in his voice. "And what are *you* doing up *here?*"

Dionisio swallowed. "I'm to, uh, look out to see if somebody comes."

"With the toziens around? You out of your mind? Who's in the skiff? Have the rest of them come down from the ship?"

"No. There's nobody in the—"

And then Dionisio stopped talking and twitched his gunbarrel up very quickly. Because Navigator Gage had glanced back towards the skiff out in the landing area just then; and while this was a kind of odd situation, Dionisio was positive the skipper anyhow wanted Navigator Gage dead, and he himself had no slightest use for the navigator. So up came the gun, and it was Dionisio who was dead in the same moment, because Navigator Gage had, after all, not glanced away to the extent of not being able to catch the motion.

Beyond the entry a lit hallway extended back into the building. Harold thought he'd heard distant human voices in there while he was talking to Dionisio, but at the moment there was silence. He checked quickly through the man's gear, found a folded gas-breather and fitted that over his face. He took off his suit coat, put on Dionisio's faded brown jacket, slapped Dionisio's visor cap on his head and set it at the jaunty angle Dionisio favored. As he finished, there was a remote heavy thump from within the building, followed in seconds by another. Jake Hiskey was still having holes blown out of the walls, looking for the hidden passages through which Professor Al-

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ston and the people working in the administration building had vanished when they got the alert signal. He should find them if he kept at it long enough. And as soon as they had the space-lock controls figured out, they'd haul down the *Prideful Sue* with the heavier raiding equipment she carried.

Dionisio's gun was the only other useful item here. Harold pocketed it, pulled the body over against the entry wall where it wouldn't be visible from within the building and set off quickly along the long hallway. Glassy motion flickered for an instant before his eyes; the toziens were still around. Now a series of five doors on the right—all locked. Ahead the hall made a turn to the right. As he came towards the corner, he heard men's voices again, at least three or four, mingled in a short burst of jabbering, harsh with excitement. Hiskey's voice among them? The ammonia smell of jolt bombs began to tingle faintly in his nostrils.

He went around the corner without hesitating or slowing his stride. The gas-breather covered half his face; and while Dionisio was about an inch shorter, they were similar enough in general build that he could be accepted as Dionisio for a few moments by men with their attention on other things. Sixty feet ahead, rubble covered the hall floor, chunks of colorful plastic masonry shaken by jolt bombs out of a great jagged hole in the left wall. Only two men in sight, standing waiting in tensed attitudes behind a semiportable gun pointed at the hole. Jake Hiskey's voice now, raw with impatient anger: "Hurry it up! Hurry it up!" A glow spilled from the hole and there was the savage hiss of cutters. Bomb fumes hung thick in the air. Hiskey and at least four of the crew here. Wait till you're right among them.

One of the men at the semiportable glanced around as Harold came up, looked away again. He went past them. The hole drove deep into the wall; evidently they'd uncovered a passage but found it sealed a few yards farther on, and the sealing material was holding. Three men were at work in there with Hiskey. The cutters blazed and a broken conduit spat vicious shorted power . . . And what damn fool had left two unused jolt bombs lying on this boulder of plastic? Harold scooped them up in passing, glanced back and saw Hiskey staring open-mouthed over at him, then clawing for his gun.

Harold dropped behind the boulder, thumbed the stud on one of the little bombs and pitched it over into the opening of the hole. The second one went in the general direction of the semiportable. Their successive shock waves rammed at his eardrums, lifted the boulder against him. Clouds of dust filled the hall. After a moment he took

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out one of his guns and stood up.

They lay where the double shock had caught and battered them. Hiskey had been coming for him, had nearly reached the boulder when he was smashed down. Harold looked at the bloodied head and was surprised by a wash of heavy regret, a brief but intensely vivid awareness of that bright yesterday in which Jake Hiskey and he first swung their ship out past the sun, headed towards high adventure. *Too bad, Jake,* he thought. *Too bad that in eight years the adventure soured so that it's ending here like this.*

McNulty and one or at most two of the original landing group left. Finish it up now before their reinforcements get here—

McNulty at any rate should be in the control room.

Harold went on along the hallway. No sounds anywhere. An open door. He approached it cautiously, looked in. A sizable office, half a dozen desks spaced out, machine stands, wall files—two of these left open. Not many minutes ago, people had been working here. Then the asteroid's alarm reached them, and like ghosts they'd vanished. At the far side of the office was another door. As he started towards it, two men stood suddenly in the doorframe. Guns went off; Harold dropped behind the nearest desk. Across the room, the two had taken cover as quickly.

A real gun fight now, fast and vicious. The crewmen were Harding and Ruse, two of the *Prideful Sue's* best hands. The office furniture, in spite of its elegant appearance, was of tough solid plastic; but within a minute it was hammered half to pieces. Harold had emptied the charge in one of his guns before he got Harding. Ruse was still pouring it at him, battering the shielding desk. There was no way to reach back at him from here. Harold took a chance finally, shifting to another desk in a crouching leap, felt pain jar up from the heel of his right leg as he reached cover. Not an immediately crippling charge, though any hit of that kind was bad enough. Now, however, lying half across the desk, he had the advantage and could pour it on Ruse and did. Pinned behind his cover, Ruse kept firing furiously but ineffectively. At last he stopped firing and tried to duplicate Harold's trick, and Harold got him in the open. The second gun hissed out emptily instants later.

Ruse had rolled on behind a low console. Only his legs were in sight. He seemed to be sprawled loosely on his side, and the legs weren't moving. It might be a trick, though Harold didn't think so. He knew he'd caught Ruse with a head shot; and even at minimum charge that should have been almost instantly fatal. But he stayed where he was and reached back carefully with one hand to get the

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gun recharger he'd taken from Connick out of his pocket. A moment's fumbling told him it was no longer there. At some point along the line it had been jolted from the pocket and lost.

But Harding should have a recharger. Harold slid back slowly off the desk and turned towards Harding's body.

And there, coming towards him in a soft heavy rush across the littered office, clutching a thick metal spike in one human-looking hand, was McNulty.

Harold slipped back behind the desk. McNulty lunged across the desk with the spike, then lumbered around it; and as he came on, his big shape seemed to be blurring oddly from moment to moment. Then a hard deep droning noise swelled in the air, and Harold knew the Rilf's thorax was spewing out its store of toziens.

The purpose was immediately obvious. The toziens couldn't touch him, but they provided a distraction. In an instant Harold seemed enclosed in roaring thunders, and the office had turned into something seen through a shifting syrupy liquid. McNulty, in addition, hardly needed help. He was clumsy but strong and fast; his broad white face kept looming up distortedly in the tozien screen near Harold. For a nightmarish minute or two, it was all Harold could do to keep some sizable piece of office equipment between the Rilf and himself. McNulty didn't give him a chance to get near Ruse's or Harding's guns. Then finally McNulty stumbled on a broken chair and fell; and with the tozien storm whirling about him, Harold managed to wrench the spike away from the Rilf. As McNulty came back up on his feet, he moved in, the spike gripped in both hands, and rammed it deep into what, if McNulty had been human, would have been McNulty's abdomen. He had no idea where McNulty's vital organs were or what they were like, but the spike reached one of them. McNulty's mouth stretched wide. If he made any sound, it was lost in the droning uproar. His big body swayed left and right; then he went down heavily on his back and lay still, the spike's handle sticking up out of him. His eyes remained open.

Harold leaned back for an instant against the edge of a desk, gasping for breath. The toziens still boiled around, sounding like a swarm of gigantic metallic insects, but they seemed to have drawn away a little; he began to see the office more clearly. Then one of them appeared suddenly on McNulty's chest. It stayed there, quivering. Another appeared, and another. In a minute, McNulty's body was covered with them, clustering, shifting about, like flies gathering thick on carrion. Harold's skin crawled as he watched

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them. They were specialized cells produced by the Rilf body, pliable or steel-hard and razor-edged, depending on what they were doing. McNulty's remote ancestor had been a hunting animal, too awkward perhaps to overtake nimble prey, which had evolved a method of detaching sections of itself to carry out the kill, not unlike the hawks men had trained on old Earth to hunt on sight. McNulty still had been able to use his toziens in that manner, releasing one or more under an inhibition which impelled them to return to him after bringing down a specific victim. Their use by the thousands for uninhibited wholesale slaughter evidently had been a more recent Rilf development, perhaps not attained until they had acquired a civilization and scientific methods. Under those conditions, the toziens ranged over an area of a dozen miles, destroying whatever life they found for almost fifty hours, until their furious energy was exhausted and they died.

Harding had been carrying a recharger, and Harold replenished his guns with it before placing it in his pocket. He looked over once more at McNulty's body, motionless under its glittering blanket, and left the office by the door opposite to the one through which he had entered. Not all the toziens had returned to McNulty. An unidentifiable number still darted about, and some stayed near Harold, attracted by his motion. He knew it because they weren't inaudible now but continued to make droning or whirring sounds as they had during McNulty's attack. Perhaps McNulty's death was having an effect on their life processes. At any rate, they no longer seemed to have any particular interest in him.

Limping a little because of the charge he'd stopped in his heel, he followed the narrow passage beyond the door to another doorway. There, at the bottom of a short flight of steps, the brightly lit deserted control room whispered and hummed. Harold hurried down the steps, looked around.

He found the space-lock controls almost immediately. And they were a puzzler. The instruments indicated that the lock was open to its fullest extent. But the screen view of the landing area showed only the skiff standing there, and the screen view of the force-field sections containing the space lock showed it wasn't activated, was shut tight. He shifted the controls quickly back and forth. There was no change in the screens. He scowled at the indicators, left them at the shut and secured mark, turned to other instruments nearby, began manipulating them.

In a minute, he had the answer. He sat down at a console, heard himself make a short laughing sound. No wonder Jake Hiskey had worked so furiously to break through into the hidden passages

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leading into the interior of the asteroid. For every practical purpose, the control room was dead. Power was here, the gadgetry appeared to be operating. But it did and could do nothing. None of it. Nothing at all.

He drew a long slow breath, looked up at the ceiling.

"Is somebody listening?" he asked aloud. "Can you see me here?"

There was a momentary excited babble of voices, male and female. Elisabeth? He discovered the speaker then, ten feet away. "Elisabeth?" he asked, a sudden rawness in his throat.

"Yes, I'm here, Harold. We're *all* here!" Elisabeth's voice told him. "Harold, we couldn't *see* you. We didn't know what was happening out—"

"The scanners, Mr. Gage." That was Alston. "The scanning circuits in that section have been shorted. We were afraid of drawing attention to you by speaking. And—"

"I understand." Harold said. "Better let me talk first because this thing isn't finished. Captain Hiskey and the men he smuggled down here from the ship are dead. So is McNulty—the Rilf. But McNulty's weapon isn't dead and should stay effective for the next two days—make it two and a half, to be safe. You can't come into this section before then, and you can't go anywhere else on the asteroid where it might have spread. It can't hurt me, but any of you would be killed immediately."

"Just what is this biological weapon?" Alston's voice asked.

Harold told him briefly about the toziens, added, "You may have thrown up those screen barriers about this section fast enough to trap them here. But if you didn't, they're all over the surface of the asteroid. And if they're given an opening anywhere, they'll come pouring down into it."

"Fortunately," Alston said, "they have been trapped in the space-lock section. Thanks to your prompt warning, Mr. Gage."

"What makes you sure?"

"They were registering on biological sensing devices covering that section until the scanners went off. The impressions were difficult to define but match your description. Every section of the asteroid is compartmentalized by energy screens at present, and no similar impressions have been obtained elsewhere. Nevertheless, we shall take no chances. We'll remain sealed off from the surface for the next sixty hours."

"You seem to have an override on the instruments here," Harold said.

"An automatic override," Alston acknowledged. "It cuts in when the asteroid shifts to emergency status. The possibility of a successful raid always had to be considered. So there is an interior control room."

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Harold sighed. Jake Hiskey and McNulty, he thought, hadn't been alone in underestimating these people. Well, let's get the mess cleaned up . . . "You've asked the SP to do something about the *Prideful Sue?*"

"Yes," Alston said. "They'll be here within a few hours."

Tozien whirring dipped past Harold's face, moved off. "She has heavier armament than they might expect," he said. "Eight men and another Rilf on board. Our gunnery isn't the worst. But tell them to give her a chance."

"I'll do that. And I'll advise the police to take precautions."

"Yes, they should. There's one more thing then. We guided a Rilf ship here and left it outside Earthsystem. It's manned by more than half a hundred Rilfs. We've been negotiating to have them take a hand for pay in Earth's miniwars. They may still try to go ahead with the deal. I think they should be turned back."

"Where is that ship now?" Alston sounded startled.

"No fixed position. But it should be moving into Earthsystem to rendezvous on your orbit. If the SP look for it, they'll find it."

Alston began to reply, but his voice blurred out for Harold. Almost as he'd stopped speaking, something had slammed into his back, below his right shoulder blade. The impact threw him out of the chair. He went on down to the floor, rolled over, twisting, on his left side, stopped, and had one of the guns in his right hand, pointed up.

Jake Hiskey's face was a smiling red mask as he leaned against the doorframe at the end of the room. There was a gun in his hand too, and he fired before Harold did. The charge shuddered into the transmitter stand behind Harold and crept quickly down. Harold pulled the trigger then, and Hiskey was flung back and fell beyond the doorframe, out of sight. Harold sucked air back into lungs that seemed tight as a clenched fist in his chest. Spent gun . . . or the hit where he'd taken it should have killed him outright. Jake had been too groggy to check that detail. Not that it was going to make very much difference.

Well, Jake, he thought, *perhaps that wasn't really the worst solution.*

The big room swung in circles overhead as he pulled himself against the stand and sat up. Then a voice was crying his name. Elisabeth.

"It's all right," Harold announced thickly, idiotically. "I stopped a hit, that's all."

Questions.

"Captain Hiskey wasn't quite as dead as I believed," he explained. "He's dead enough now."

The voices grew blurred. Harold decided he was, definitely, fin-

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ished. It might take a while. But the charge, spent though it had been, would start him hemorrhaging. In an hour or two heart and lungs should be dying mush. Wicked guns, thorough guns—

". . . Immediate medical attention . . ."

Oh, sure.

But he was listening now to what they were telling him, and abruptly he became alarmed. "No one can come in here," he said. "I told you why. Not even in armor. Lift the screens anywhere while the toziens are alive, and they'll pour through They're too fast to stop. You'll have to wait till you know they're dead."

Then there was, they said, another way. Between this section and the next was a small emergency personnel lock—if he could follow their instructions, if he could reach it. A suit of armor couldn't pass through it, but Harold could. And once he was inside the lock, sensing devices would establish with complete reliability whether any Rilf toziens had entered it with him.

Harold considered that. It seemed foolproof.

"All right," he said. "We'll see if it works." He began struggling up to his feet. "Just keep those screens down."

Some while later he reached the main entry to the control room, glanced down at Jake Hiskey and turned to the right, as they'd said. Toziens went with him, drawn towards the only thing that still moved in the section. There came a passage, and another one, and a door and, behind the door, a small room. Harold entered the room and looked around. "I think I'm there," he said aloud.

"Yes, you're in the right room," Alston's voice told him. "You won't see the lock until it opens, but it's in the center of the wall directly opposite the door."

"Don't open it yet," Harold said. "They're here, too."

He got across the room. As Alston had told him, there was nothing in the smooth bare wall to suggest an emergency lock behind it, but he was lined up with the center of the door on the other side, as well as he could make it out; and he should be within a few feet, at most, of the lock.

"Professor Alston," he said.

"Yes?"

"I'm in front of the lock now. Wait till I give you the word. Then open it fast."

"We're ready," Alston said. "We'll know when you're inside."

Harold fished the two guns from his pockets, took them by their barrels in one hand, turned around. Supporting himself against the wall with his other hand, he lifted the guns and began waving them about. Tozien droning drew in towards the motion, thickening, zigzagging back and forth above and in front of him. Then he pitched the guns towards the far corner of the room.

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The droning darted off with them. They hit the wall with a fine crash, went clattering to the floor. The air seethed noisily above them there.

"Now!" Harold said.

He saw the narrow dark opening appear in the wall two feet away, stumbled into it. After that, he seemed to go on stumbling down through soft darkness.

At first there was nothing. Then came an occasional vague awareness of time passing. A great deal of time . . . years of it, centuries of it . . . seemed to drift by steadily and slowly. Shadows began to appear, and withdrew again. Now and then a thought turned up. Some thoughts attracted other thoughts, clusters of them. Finally he found he had acquired a few facts. Facts had great value, he realized; they could be fitted together to form solid structures.

Carefully, painstakingly, he drew in more facts. His thoughts took to playing about them like schools of fish, shifting from one fact to another. Then there came a point at which it occurred to him that he really had a great many facts on hand now, and should start lining them up and putting them in order.

So he started doing it.

The first group was easy to assemble. In the process, he remembered suddenly having been told all this by one of the shadows:

The men left on the *Prideful Sue* had elected to put up a fight when the System Police boats arrived, and they'd put up a good one. (They should have, a stray thought added as an aside; he'd trained them.) But in the end the *Prideful Sue* was shot apart, and there'd been no survivors.

The Rilf ship, edging into Earth-system, turned sullenly back when challenged. By the time it faded beyond the instrument range of its SP escort, it was a quarter of a light-year away from the sun, traveling steadily out.

That seemed to clear up one parcel of facts.

Other matters were more complex. He himself, for example—first just lying there, then riding about on one of the small brown cattle which had once been a wild species of Earth, finally walking again—remained something of a puzzle. There were periods when he was present so to speak, and evidently longer, completely vacant periods into which he dropped from time to time. When he came out of them, he didn't know where he'd been. He hadn't noticed it much at first; but then he began to find it disturbing.

"Well," Elisabeth said gently—she happened to be there when he started thinking seriously about this odd practice he'd developed—"the doctor said that, aside from more obvious physical damage, your nervous system got quite a bad jolt from that gun charge. But you *are* recovering, Harold."

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So he was recovering. He decided to be satisfied with that. "How long has it been?" he asked.

"Not quite four weeks," said Elisabeth. She smiled. "You're really doing very well, Harold. What would you like me to show you today?"

"Let's look at some more of the things they're doing downstairs," Harold said.

Professor Derek Alston's asteroid also remained something of an enigma. In Mars Underground, and in the SP Academy's navigation school, the private asteroids had been regarded much as they were on Earthplanet, as individually owned pleasure resorts of the very rich which maintained no more contact with the rest of humanity than was necessary. Evidently they preferred to have that reputation. Elisabeth had told him it wasn't until she'd been a Solar U student for a few years that she'd learned gradually that the asteroids performed some of the functions of monasteries and castles in Earth's Middle Ages, built to preserve life, knowledge and culture through the turbulence of wars and other disasters. They were storehouses of what had become, or was becoming, now lost on Earth, and their defenses made them very secure citadels. The plants and animals of the surface levels were living museums. Below the surface was a great deal more than that. In many respects they acted as individual extensions of Solar U, though they remained independent of it.

All of which seemed true, from what he had seen so far. But the thought came occasionally that it still mightn't be the complete picture. There were the projects, for one thing. This miniature planet, for all that it was an insignificant speck of cosmic debris, had, on the human scale, enormous quantities of cubic space. Very little of the space was in practical use, and that was used in an oddly diffused manner. There were several central areas which in their arrangement might have been part of a residential section of Mars Underground. Having lived mainly on an interstellar ship for the past eight years, Harold found himself reflecting on the fact that if the asteroid's population had been around a hundred times its apparent size, it would not have been unduly crowded. Elsewhere were the storerooms; and here Elisabeth loved to browse, and Harold browsed with her, though treasures of art and literature and the like were of less interest to him. Beautiful things perhaps, but dead.

And then the projects—Step into a capsule, a raindrop-shaped shell, glide through a system of curving tunnels, checking here and there to be fed through automatic locks; and you came to a project. Two or three or at most four people would be conducting it; they already knew who you were, but you were intro-

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duced, and they showed you politely around. Elisabeth's interest in what they had to show was moderate. Harold's kept growing.

"You're running some rather dangerous experiments here," he remarked eventually to Derek Alston. This was on another day. There'd been only a scattered few of those blank periods lately.

Derek shook his head. "I don't run them," he said. "They're Solar U and SP projects. The asteroid merely provides facilities."

"Why do you let them set themselves up here?"

Derek Alston shrugged. "They have to be set up somewhere. If there should be some disastrous miscalculation, our defensive system will contain the damage and reduce the probable loss in human lives."

And the asteroid had, to be sure, a remarkable defensive system. For any ordinary purpose it seemed almost excessive. Harold had studied it and wondered again.

"In Eleven," he said, "they're working around with something on the order of a solar cannon. If they slip up on that one, you might find your defensive system strained."

Derek looked over at him.

"I believe you weren't supposed to know the purpose of that device," he said idly.

"They were a little misleading about that, as a matter of fact," said Harold. "But I came across something similar in the outsystems once."

"Yes, I imagine you've learned a great deal more there than they ever taught in navigation school." Derek scratched his head and looked owlish. "If you were to make a guess, what would you say was the real purpose of maintaining such projects on our asteroid? After all, I have to admit that the System Police and Solar U are capable of providing equally suitable protective settings for them."

"The impression I've had," Harold told him, "is that they're being kept a secret from somebody. They're not the sort of thing likely to be associated with a private asteroid."

"No, not at all. Your guess is a good one. There are men, and there is mankind. Not quite the same thing. Mankind lost a major round on Earthplanet in this century and exists there only in fragments. And though men go to the outsystems, mankind hasn't reached them yet."

"You think it's here?"

"Here in Solar U, in the System Police, in major centers like Mars Underground. And on the private asteroids. Various shapes of the same thing. Yes, mankind is here, what's left of it at the moment. It has regrouped in Earthsystem and is building up."

Harold considered that. "Why make it a conspiracy?" he asked then. "Why not be open about it?"

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"Because it's dangerous to frighten men. Earthplanet regards Earthsystem as an irritation. But it looks at our lack of obvious organization and purpose, our relatively small number, and it doesn't take alarm. It knows it would take disproportionate effort, tremendous unified effort, to wipe us out, and we don't seem worth it. So Earth's men continue with their grinding struggles and maneuverings which eventually are to give somebody control of the planet. By that time Earthsystem's mankind should not be very much concerned about Earthplanet's intentions towards it. The projects you've seen are minor ones. We move farther ahead of them every year, and our population grows steadily. Even now I doubt that the planet's full resources would be sufficient to interfere seriously with that process. But for the present we must conceal the strength we have and the strength we are obtaining. We want no trouble with Earth. Men will have their way there for a time, and then, whatever their designs, mankind will begin to evolve from them again, as it always does. It is a hardy thing. We can wait . . ."

And that, Harold decided, had been upper echelon information, given him by one who might be among Earthsystem's present leaders. Elisabeth and Sally Alston had a general understanding of the situation but did not seem to be aware of the underlying purpose. Professor Alston evidently had made him an offer.

He thought about it, and presently a feeling began to grow in him, something like loss, something like loneliness. Elisabeth appeared to sense it and was disturbed.

Then another day. A gun was in his hand again, and in his other hand were the last three of a dozen little crystal globes he'd picked up in one of the machine shops. He swung them up, and they went flying away along a massive wall of asteroid rock. As they began to drop again, the gun snaked out and, in turn, each of the globes sparkled brightly and vanished.

He'd been aware of Derek Alston coming up from behind him before he fired; and now he pocketed the gun and turned.

"Very pretty shooting, friend!" Derek remarked. "I never was able to develop much skill with a handgun myself, but I enjoy watching an expert."

Harold shrugged. "I had the time, and the motivation, to put in a great deal of practice."

"No doubt." Derek held up a sheaf of papers. "Your final medical and psychological reports! It appears you've come all the way back. Care to look them over?"

Harold shook his head. "No. I've known for a couple of days that I'd come all the way back." He patted the pocket which held the gun. "This was a test."

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They regarded each other a moment. And now, Harold wondered, how was he going to say it? The Alstons had been more than generous hosts, and Derek took pride in what Earthsystem was accomplishing—with very good reason.

But he'd moved for eight years among the stars. And in spite of all the plans that had gone sour, and the ugliness which tarnished and finally destroyed the *Prideful Sue,* he'd found there what he'd been looking for. Earthsystem seemed dwindled and small. He couldn't possibly come back to it.

Make it brief, he thought.

"I'm not sure what I'll do next," he told Derek Alston. "But I'm shipping transsolar again."

"Well, I should hope so!" said Derek promptly.

"I was wondering whether you'd understand . . . Elisabeth in particular."

"Of course she understands! I do —we all do!" Derek smiled. "But before you start talking of leaving, there's one more project I must show you. It's one you should appreciate . . ."

They stepped, a minute later, out of a capsule deep in the bowels of the asteroid, and went along a passage with steel bulkheads. A massive lock opened at their approach, and lights came on.

"Come on in and look around," Derek said. "This is our third control room. Not too many people know we have it."

Harold looked around the shining place. First incredulously, then with something like growing awe. He glanced at Derek Alston. "Mind if I check these?" he asked.

"Not at all. Go ahead."

Once, some two years before, he'd been in the control room of Earthplanet's biggest, newest, and proudest outsystem transport. What he'd seen then was dwarfed, made trifling and clumsy, by what was here. His skin shivered with a lover's delight. "You have power to go with it?" he asked presently.

"We have the power."

"Where's the asteroid going on interstellar drives?"

"I told you mankind hadn't got to the outsystems yet," Derek said. "But it's ready to move there. We've been preparing for it. The outsystems won't know for a while that we're around—not till we're ready to let them know it."

"This asteroid is moving to the outsystems?"

"Not this one. Not for some years. We still have functions to perform here. But a few others—the first—will be ready to start within the next three months. They can use an experienced transsolar navigator. They think they can also use a fighting captain with an outsystem background. If you're interested, I'll take you over to one of them this afternoon."

Harold drew in a long, deep breath.

"I'm interested," he said. ■

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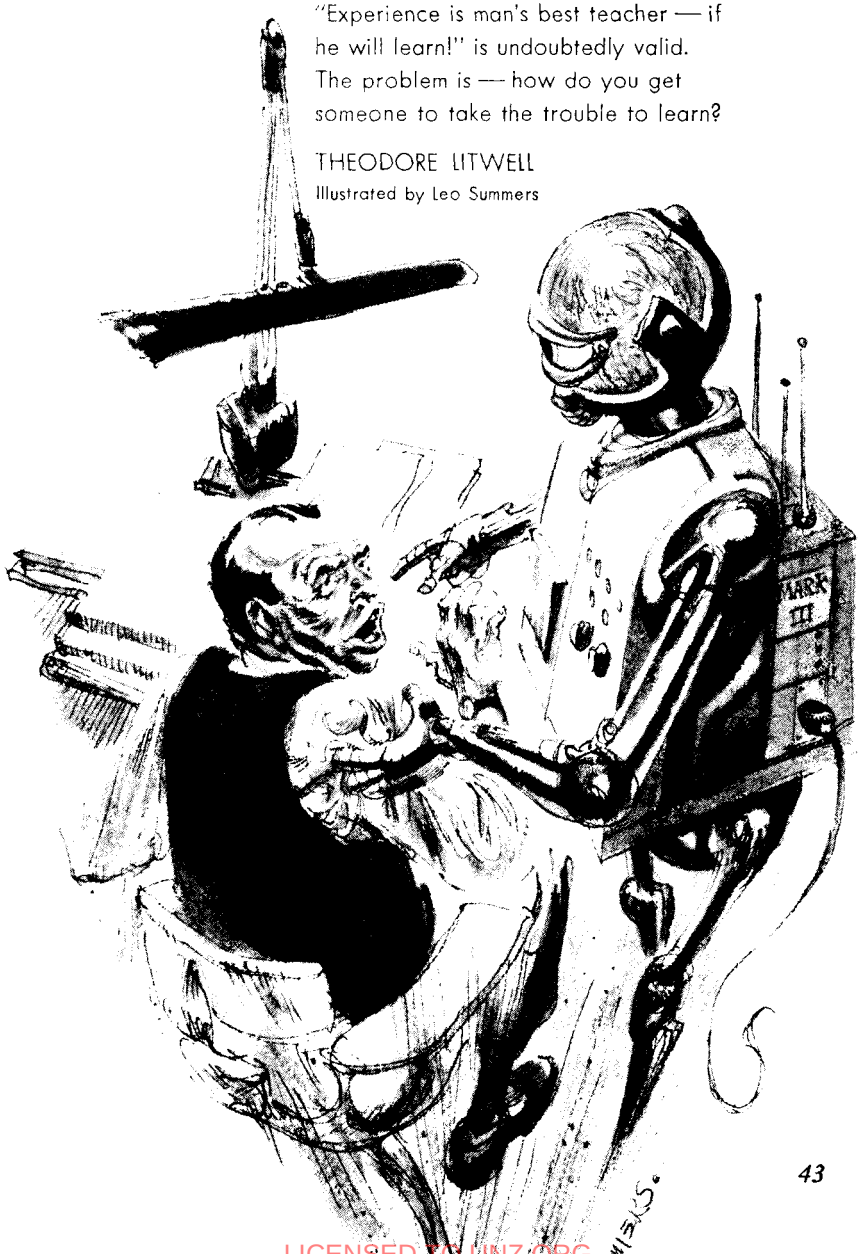
A learning experience

"Experience is man's best teacher — if he will learn!" is undoubtedly valid. The problem is — how do you get someone to take the trouble to learn?

THEODORE LITWELL

Illustrated by Leo Summers



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Herbert Jessup ran his tongue over his dry lips, awed by the sheer bulk of the wooden shipping crate in front of him in the modest living room of his small suburban house. The stenciled "ROBO-TUTOR" loomed, large and ominous, from the upper edge of the seven-foot box. Jessup scratched his balding scalp meditatingly, apprehensively scanning the mimeographed sheet varnished onto the crate.

The usual warnings and cautions, he realized somewhat nervously, but not to be taken lightly this time. A six-week lease provision, a results-guaranteed provision, the hideously severe abrogation of contract clause . . . all right there under the varnish glaze. He opened a small plate midway up the crate to expose the activator stud.

His clammy finger wavered uncertainly above the steel press plate that would begin his six-week home-study course. He had been warned that education was not always an easy or pleasant experience, but, he thought resolvedly, a man needs an education nowadays, even if he is forty-five and only marginally educable. Besides, he realized grimly, he'd barely made it through two years of college, which easily put him in the lower four percent of the job force.

Jessup steeled himself and jabbed hard on the stud. Sweat popped out in small beads on his forehead. Minutes passed and nothing happened.

Suddenly a massive steel fist slammed through one side of the crate, partially splintering it. Jessup sprang back, terror rising in his mind, as a second gleaming fist shattered more of the crate. A huge foot kicked upwards, demolishing the rest of the crate. Trembling and fearful, Jessup edged slowly away from the exposed machine.

The robo-tutor flexed itself, making small motions with its steel-gray arms and legs and twisting its neck. It stopped and regarded Jessup.

"I am your Martax Industries Mark III Robo-tutor. You are Herbert Jessup?" The voice was harsh, but clear enough to be readily understood booming in the small living room. Jessup stopped edging away and regarded the machine wonderingly.

"I am. But I wanted a teaching machine, and I'm sure there must be some sort of mistake."

"You underwent the Martax psychological battery of examinations and found to be point eight five susceptible to advanced techniques of adult education." The machine stopped, staring rigidly at Jessup.

He swallowed the lump in his throat and tried to find a reason for this foul up. Why, he'd mortgaged one third of his anticipated salary for fifteen years just to get a decent education, and they send him this!

"But this is crazy! I want to learn computer programming, and I've got a request in for a sophisticated teaching machine . . ."

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"I am the teaching machine you ordered. Shall we begin?" The voice was hurting Jessup's ears, but the machine seemed determined. It strode heavily towards him, stopping a few feet away and glaring down at him.

"Well, if you insist that you're the right machine. I have the company's library of workbooks over here." He pointed to a bookcase sitting next to the plain wood desk in his living room. The machine nodded. Odd, Jessup thought, that a robot should be able to nod. It seemed to be designed to have a personality of its own. The robot looked back at Jessup.

"We shall have uninterrupted privacy, as per contract specifications, for the next six weeks?" The robot's head inclined downwards inquisitively.

"Why, yes, I've let it be known that I'll receive no visitors and won't need to go out during the course."

"Good. Then let's begin. Workbook Number One is an introduction to differential and integral calculus, plus elementary matrices. Get it out, please."

Jessup took the red-bound volume from the shelf and sat down at the desk obediently. He opened it to the first page and looked at the meaningless scrawls he'd made while trying to study the stuff earlier. This stuff was just beyond him, but the machine carried a guarantee, and if this failed, he could get his money back on the books, too. He looked over his shoulder at the machine standing behind him.

"Quiz One: Understanding of the delta notation."

Jessup cupped his hands over his ears and protested angrily, "Can't you lower your voice? And what's this about Quiz One? I haven't done any of this yet?"

"Very well. Please follow in your book as I explain. Delta is a Greek symbol used to designate a change in a quantity . . ." Jessup started to get up but a large hand grabbed his shoulder and shoved him back down in the seat. He squirmed under the tight grip and looked up at the robot angrily.

"Let go! What are you trying to do, kill me?"

The machine paused and looked back down at Jessup wriggling in the chair.

"Mr. Jessup, your principal handicap is a lack of concentration. I am a machine designed to direct your attention and improve your concentration. Your contract states that no harm shall come to you during the course, but provides excessive penalties for failure to complete the course, including forfeiture of payment plus garnishment of your lifetime wages."

Jessup settled down and stopped squirming. The machine lifted its hand and Jessup rubbed the sore muscles in his shoulder while silently cursing the machine.

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"Please read and follow along as I explain. Delta is . . ."

Jessup tried to follow the robot in his book, but thoughts of the job that could be his if this worked kept cropping up. His mind wandered and then snapped back as he realized with a sinking feeling that he had not followed the robot's explanation at all.

"Quiz One: Understanding of the delta notation."

Jessup looked up and interrupted the machine. "I don't understand the delta process. Couldn't we go over it again?"

The machine paused a moment, and then Jessup felt a metal thumb and forefinger pinching him around the nerves of his neck. He started to scream, but the robot boomed, "Pay attention! Look at your book and follow along."

The robot's voice was louder than ever now, thundering in the small confines of the house. Jessup felt his head being forced over the open book, and the robot's other hand pointed towards the lines he was explaining.

"Delta! Delta notation! Delta indicates a change in a quantity or thing. Do you understand?"

Jessup read. "Delta X. Change in X. The delta represented a change in a quantity."

"Yes! Yes, I understand!" Jessup screamed, still staring straight ahead at the book. The robot withdrew his hand from Jessup's neck.

"Very well. Changes represented by delta are finite, but may approach zero; that is, they may become infinitesimally small."

Jessup followed the robot's pointing finger, and slowly the idea of an infinitesimal change began to soak in.

Days passed and Jessup learned to hate the robot. When he would complain, it would bat his head between its hands until he would groggily look back at the book. It screamed constantly. It had every mannerism of a sadistic torture-chamber proprietor, and seemed to delight, as much as Jessup had ever seen any machine delight, in abusing Jessup physically and mentally at every chance. But he was learning. Slowly, Jessup was mastering the fundamentals of computers.

At night Jessup melted the robot in his dreams. He dismembered it and reassembled it in grotesque shapes. He shattered it, crushed it, disintegrated it, fused it, dropped it off tall buildings, ran over it with trains, and destroyed it in thousands of novel, delightful ways.

Jessup lived for the day when his lease would be up on the monster and he would be a free man. He thought that there should be some constitutional provision against this sort of abuse, but he realized bitterly that the contract was a proven, enforceable one.

So quietly, inwardly, Jessup stewed and hated and planned for the day he would take his sweet, overdue revenge.

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As Jessup came to understand the inner workings of computers, he began to wonder what sort of sadist could have designed the robo-tutor. It did things that were totally unnecessary and degrading, but still Jessup continued to learn. And plan.

Jessup stared vacantly at the dark ceiling, thinking about the machine plugged into a wall socket in the next room. Two and a half weeks to go, and he was through already. He hated the machine, really hated, as he had never hated or loved anything in his dreary life.

Besides, he realized a little amazed, he didn't need the machine any more. He could walk in and read the material himself, and if it didn't come to him the first time, he would reread and think about it until he understood. If he ever hoped to respect himself again, he thought grimly, that machine had to go. Tonight.

Cautiously Jessup peeled the sheets off and rolled softly out of bed and onto the floor. Stealthily he crept past the partly-open door of the spare bedroom where the robot was absorbing power. He made it to the living room, got a screwdriver out of his desk drawer and a roll of aluminum foil from the kitchen and began working.

First he removed the plastic cover of an electric socket and ran a thin strip of aluminum foil to a larger strip stretching all the way across the living room floor, Then he ran another thin strip up and across the ceiling and taped a piece of foil so as to hang down about a foot below the height of the robot's head.

Jessup went into the kitchen and carefully bypassed the wires around his circuit breaker box so that the living room circuit would draw full line power, even if his house wiring should melt. He went back into the living room to admire his handiwork.

He put a hand on each hip and swaggered a couple of steps towards the foil strips. He felt a heady wave of brash daring well up within himself as he thought of the pure, sublime hatred he felt for the monster in the next room.

"I'm through with your crummy, stinking course!" he yelled, throwing his head back and hurling curses at the machine. Jessup heard movement in the next room and in a moment he was facing his persecutor across the foil-boundary strip. The machine contemplated him silently.

A lump formed in Jessup's throat and his hands felt clammy on his hips. He yelled again, "I'm not putting up with you for another day! Get out of my house!"

The machine started towards him, both huge hands outstretched as if to seize him. The robot hit the dangling foil strip and stopped dead, hands frozen in the outstretched position, tiny blue sparks

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playing between the gently waving foil and the robot's head. Slowly it began to topple forward, hitting the floor with a resounding, satisfying crash. Its programmed data banks were sterilized, uniformly cleared by the surge of electric current.

Jessup went to the wall switch and turned off the current. He picked up his screwdriver and went to work.

He started to remove a small access plate on the back of the robot's neck when the phone rang. He jumped, startled. That line was closed to everyone but Martax for the six weeks!

Jessup walked slowly over and picked up the phone, his nervous hands trembling uncontrollably.

"Mr. Jessup? Mr. Jessup?"

"Yes?" He gasped into the phone.

"Mr. Jessup, we just received the attempt-to-destruct signal for your registered robo-tutor and are sending Mr. Simpson over to investigate immediately. Please do not further damage the mechanism or attempt to leave the house." Jessup started to slam the phone down and run when the voice finished, "As of now you have not violated the contract and are not liable, as long as you see Mr. Simpson tonight, to any damages. Do you understand, Mr. Jessup?"

Jessup gulped and relaxed slightly. "Yes, thank you; I'll be here." He put the phone down gently and collapsed, exhausted, into a chair.

Headlights swept across his living room wall as a car pulled into his driveway. He got up and went to the door to open it before his guest rang. A neat, well-dressed middle-aged gentleman bounced energetically up onto the porch and beamed at Jessup.

"Ah, Mr. Jessup!" he said, smiling broadly. "I hear you passed your crisis tonight!" Jessup stared at him blankly, not knowing what to say.

"Won't you come in, Mr. Simpson?" he asked nervously, opening the door. The man stepped inside and immediately saw the inert robot on the floor.

"A rather neat trick, that foil." He looked at the dangling strip approvingly. "Is it still hot?"

Jessup scratched his neck and tried to make sense out of what was happening. "No, I shut it off." He motioned Simpson to a seat and relaxed onto the divan. "Mr. Simpson, I really would appreciate an explanation of what makes you so happy about the loss of an expensive teaching machine." He stared hopefully at Simpson, who leaned forward and folded his hands.

"Well, to begin with, that," he said, pointing a thumb at the robot, "is merely a mobile readout unit, a time-sharing operation with several hundred similar units operated from our central teaching computer complex.

"Secondly," he continued brightly, "you, Mr. Jessup, have de-

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veloped a concentration span many times greater than you previously possessed, as evidenced by a not too badly executed piece of robotic assassination."

Jessup clasped and unclasped his hands, confused, and started to protest, but Simpson put up a hand to silence him.

"No, no, Mr. Jessup, this is not something you were capable of previously. Formerly you were unable to nurse significant anxieties, and as a result your schoolwork indicated a lower intelligence than the Martax tests found you to have.

"You see, Mr. Jessup, the average college counselor, if you were so fortunate as to come to his attention in spite of normal aptitude scores, would consider you a dull student and try to reconcile you to the fact. In fact, you are one of a sizable number of people who have been told that you are not responsible for things that you just can't do, and as a result you have never worried sufficiently about failing to do anything about it. Not at the conscious level, of course, but inside you have never felt a real, driving anxiety which normal persons possess.

"It would be impossible to correct this situation in an adult without being able to inspire a minimal anxiety. The first step was when you, of your own free will, contracted for our course, which is purposely billed as difficult and harassing.

"The robo-tutor unit is designed to inspire physical anxiety at the most primitive level, holding you completely responsible for everything you are potentially capable of. You see, by forcing a change in your outward behavior, we have forced a genuine change in your inner behavior. Is it not true?" He looked questioningly at Jessup.

Jessup thought for a moment, clasping his knees with his hands and leaning back. "Yes," he muttered thoughtfully, "yes, there's a real change, I believe. The last few days the machine has been harassing me, but that wasn't what was making me learn. It was something inside that said, 'Jessup, it's you that's learning this stuff, not the machine, so pay attention and learn.' "

Simpson smiled broadly, obviously delighted. "Of course, Mr. Jessup!" He sprang to his feet and extended a hand to Jessup, who took it and shook it heartily. "Quite perceptive, Mr. Jessup; it's always hard to see a change in oneself." He coughed lightly. "I had the same experience myself, eight years ago, when I signed up for Business Administration tutoring out of sheer desperation."

Jessup felt his mouth drop in surprise. "You had a robo-tutor course? I mean, did you finish it or . . ."

"Oh, no," Simpson smiled, "I tried drowning mine." He grimaced. "Ineffective, of course;

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the circuitry was waterproof, but then basic electronics wasn't part of Business Administration. It was the Mark I model, and I don't think I even damaged it. But you see," he beamed, "I get a sort of personal satisfaction out of seeing another man like myself realize his true potential. It's almost a religious thing with me, you see?"

Jessup grinned. He did see. "But what about the rest of the course?" he asked anxiously.

"In residence, Mr. Jessup. It will actually require almost an additional year to make you proficient, but," he said, winking knowingly, "the people we are trying to reach would not accept a course longer than six weeks. And that is the usual maximum time required for development of the concentration span, and after that, well," he said, pausing thoughtfully, "after that their goals usually change and they really want to learn for reasons other than the salary; for the first time in their lives, they know the satisfaction of accomplishment through hard work."

Jessup rubbed his chin thoughtfully, wanting very much to ask a certain question. "Mr. Simpson," he began haltingly, groping for the words, "you said you'd had this course, and about what an almost religious thing it is with you and all . . ."

Simpson put a hand on his shoulder and squeezed, smiling. "If you mean you want to work in Special Education with Martax, I'm sure it can be arranged. See me tomorrow morning about it. I'll have a man out to pick up the machine." He slapped Jessup on the shoulder and turned to leave. "Tomorrow morning, Mr. Jessup. Your academic education will begin then."

He left quickly, thought Jessup, probably expecting another crisis.

Jessup looked silently, sadly at the inert robot. It didn't have a real personality, of course, except so far as someone who designed it cared about the problems of people like him. Perhaps that was what really counted; at least he would try to care himself as he worked on the design of the Mark IV. ■

The Analytical Laboratory / September 1968

PLACE	TITLE	AUTHOR	POINTS
1.	The Tuvela	*James Schmitz*	1.62
2.	Hi Diddle Diddle	*Peter E. Abresch*	2.46
3.	The Powers of Observation	*Harry Harrison*	3.11
4.	A Flash of Darkness	*Stanley Schmidt*	3.82
5.	Parasike	*Michael Chandler*	3.86

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The form master

JACK WODHAMS

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Wodhams, who is a "down-under" author, appropriately seems to specialize in magnificent inversions of things expected and conventional. Like the Form Master, for instance . . .

Illustrated by Kelly Freas

"The machine can't be wrong!" the supervisor screamed as they carried him away. "The machine can't be wrong!"

But there is always human error. And, more to the point, human sabotage.

A slender lead, one persistent inquirer, two leads. Shortly four leads, tugging in contrary directions, each one requiring its own sniffing hound.

In less than a day the first agent found so many threads that he felt himself being wrapped in a cocoon. On the second day a half-dozen more agents were deployed to help ferret into the background of Sygnet Meaman, a character suddenly found to be interesting. In no time at all the agents were tripping over each other chasing authentic conflicting reports and were being overwhelmed by a multiplicity of trails that led off in all directions. There were too many trails.

"He could have been born here," the parson said, "but our records have been destroyed by a fire . . ."

"Meaman, wasn't it? Yes, here we are. Ah, tragic case. His wife was among the victims of the JV 42 that went down in the Andes shortly . . ."

"He was a New Zealander. He took out naturalization papers three years ago . . ."

"Old Judge Finchecliffe is as blind as a bat, but he's very obliging . . ."

"He insisted on filling out the hire contract himself, see? And, well, it was a little thing, a legal technicality, but, uh, somehow it got that *we* had to send instalments to *him* . . ."

"He was identified by his mother and his brother. They paid to have him cremated . . ."

"I'm sorry, sir, his file is on the

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classified list. Mr. Meaman is engaged on top-secret government work . . ."

"Under the Native Affairs Bill, Section 17, as an Indian he has the right . . ."

"We have a Sigmund Meahan graduated from here—Are you sure you have the name right?"

"Genealogically he can prove kinship to the President . . ."

". . . Changed his name by deed-poll to—"

". . . Diplomatic immunity—"

". . . Small war pension—"

". . . He registered here in—"

". . . He applied—"

". . . Perfectly in order—"

By the third day the team was bogged down in superabundant data with a long way to go and nothing in sight but chaos. More men could not be spared and at the Federal Agency office Senior Doby Pinsher became more and more horrified at the mounting mass of incredibly interweaving detail. The growing volume of mixed bureaucratic and private paperwork that seemed attached to the name "Meaman" deeply troubled him by its apparent endlessness.

Pinsher shuddered. He weighed his chances of gain and success against the time-consuming waste of pursuing each item to its origin. He could not afford the manpower for the months, perhaps years, that it would take. In Sygnet Meaman they had come up against an entrenched craftsman.

Pinsher sent for Hubert Rakely.

He was suspicious. "Who are you? What do you want?"

The young man on the screen was fresh-faced and innocent-looking. He was seeking entry from the foyer below. "You are Mr. Sygnet Meaman?"

Meaman shortly admitted that he was.

The young man smiled artlessly. "I'm Ferdinand, Uncle Syg."

"Ferdinand? Ferdy? Ned's boy? Good heavens, however did you find me?"

"It wasn't easy," the young man said. "Can I come up and see you?"

"I'm not Mae West," Meaman warned. "Ned's boy, fancy that. The last time I saw you was years and years ago. Hah! You made me change my shirt."

Ferdinand grinned. "I heard about that. My habits have changed and I can promise that it won't happen again."

Meaman laughed and waved a plump arm. "Come on up," and he pressed the elevator release.

Meaman handed Ferdinand a drink. "And how is your father? Still plodding away with Interwide Insurance?"

"Uh." Ferdinand gulped. "Dad's Managing Coordinator now."

"*Is* he? Well, well. But then, I'm not really surprised, He was always the solid dependable one. Enough soda for you?"

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"Yes, thanks . . . that's enough."

Ferdinand sat and cooled his palms on his glass as Meaman went to seat himself behind a huge desk. "Hope you don't mind me taking up this distant position," Meaman said. "I'm expecting a call and I rather want to be prepared."

"That's O.K.," Ferdinand said. "You want I should leave when it comes through?"

"Aw, I don't think so." Meaman winked archly. "You're one of the family. If I know Ned, your education is probably lacking. Does he know that you're here?"

"Uh, Dad . . . didn't talk about you much. Naturally I got curious about my Uncle Sygnet. And Mom, well, she seemed to think—"

"Ah, yes, Eloise." He recalled a wary young woman. "How is your dear mother? She remembers me not unkindly, I hope?"

"Mom? No. Well," Ferdinand gently swirled the liquid in his glass, "I guess she's easier on you than Dad. You, uh . . . they don't sort of talk about you much. I"—he placed a set of icecold fingers against a blemish on his temple—"got the idea that you were . . . well, some kind of renegade."

"Your Uncle Sygnet is a nonconformist by desire and conviction," Meaman stated bluntly, "and my experience manifestly supports the view that individual enterprise is still supreme. I myself seek every opportunity to show that man can triumph over machinery and regimentation."

"Oh. Ah. Dad said something like that, only he put it differently. Dad said you're a disruptive, uh . . . Oh, well, you know what Dad is."

Meaman humphed. "Is he still the same? Yes," he nodded, "I suppose he would be. A stickler for convention, your father. Ah me. Poor old Ned."

"Uncle Syg, uh . . . why did you, uh . . . Dad said that you are at war with organized society. Are you, Uncle Syg? What made you, eh . . .?"

"What opened my eyes? Lad, it can happen to anybody. It is an awakening, that's all. Do you know how it happened to me? Well, I'll tell you Ferdy, for the realization can be of great benefit to you."

Meaman leaned on one arm of his incongruously plush swivel chair. The magnificent desk with its communications accoutrements, the generous chair, the heavy drapes framing the window, these parts were in line of fire of the viewer. Apart from the visitor's chair that Ferdinand sat in the room was otherwise bare of furniture, carpet or decoration. There was not so much as a tradesman's calender to brighten the dingy walls.

"When I was not much older than you are now," Meaman said, "I applied for a job. Well, they

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gave me this great big form to fill in . . . you know the type of thing. They wanted to know everything, the nationality of my old grandmother, what my great-grandfather died of, and a lot of other personal and intimate details. Well, I was only applying for a position as bookkeeper, so right then and there I began to wonder just how truthful I needed to be.

"Ferdy, these days there are thousands of forms. Over half the work force is employed in offices. If a form seems to be filled in correctly and looks right, who is going to argue about it? And one form leads to another, and you'd be surprised how quickly the substance of a personality can be created to suit various purposes."

"Dad said you misrepresented yourself." Ferdinand observed, holding his glass in front of him, elbows on his knees. "He said you made things up, pretended to be who you weren't."

"A true actor lives his role. We act who we think we are, or who we would like to be. Either way is a lie. Life is the way we act it, and to get what we want out of life we had best pick parts that suit our character and temperament."

"Yes, Uncle Syg, but Mom said you once pretended to be a count. That's, uh, a bit, you know . . ."

"I was a Hungarian count," Meaman said. "A mild and innocent deception. Certainly I felt the equal of a count. Still do, come to that. The difference between a count and me is negligible."

"Except that a real count is a real count."

"You echo your mother," Meaman depreciated. "She held a similarly narrow view. A great many people are indoctrinated, Ferdy my boy." His head wagged. "In this world of motley diversity it is amazing how many people feel constrained to reply honestly to every item on a form. They are, of course, afraid to trip. This, to me, is a useful general attitude that promotes unquestioning. Form-filling is a fascinating hobby and the supply is virtually inexhaustible. Some of them are beauties, like this one," Meaman held up half-a-yard of questionnaire, "it's an application form to obtain more forms. Aha!"

The "Aha!" was to the sounding of a buzzer. "This will be my caller," Meaman said. "He's a smart-aleck speculator. Now, Ferdy lad, I want you to stay quiet while I handle this. Just watch, hey? You might learn something."

Meaman threw the switch to receive the call.

On one side of his desk he had a two-panel monitoring frame. In the left-hand panel was the face of his caller; in the right-hand panel was reproduced the face of one of the young women at a busy switchboard. "Royaltechs, Inc.,"

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she said brightly. "Can I help you, sir?"

"Yes. My name's Cooper. I'd like to speak to the Managing Director, Mr. Meaman. He's expecting me to call."

"Hold the line, please."

The right-hand panel jumped to jittery opacity for twenty seconds. The screen cleared abruptly to portray an elegant young lady in a spaciously luxurious outer office. "Hello" her voice was well modulated to bring new hope to old thought patterns, "Mr. Meaman's suite. Who is calling, please?"

The Cooper image ogled. "My name is Cooper, Jedzet Cooper. Mr. Meaman asked me to call in regard to a certain business matter."

Meaman's fingers toyed with buttons on a hidden console.

"Will you hold on, please," the young lady said. "Mr. Meaman is very busy just now. I shall have to inquire." Her eyelashes fluttered. "Excuse me."

Again the screen blanked, this time for a crackling half-minute. Then a scene with a man in a white coat backgrounded by hummingly impressive factory activity. He was saying, ". . . Just installed, Sir Charles. Production will be tripled and . . ."

The scene vanished. A few moments more of pulsating static. The return of Meaman's secretary. "Mr. Meaman will see you now," she said. "I'll put you through."

Meaman reached forward and pushed the monitoring frame out of the line of vision of his direct receiver. He spread himself. His finger punched, and he looked up from papers on his desk as Cooper's features filled the tube. "Ah. Er . . . it's Mr. er, Cooper, is it? Yes. Well, ah, what can I do for you Mr. ah, Cooper?"

"It's about that matter we were talking over in the club last night."

"The club? Last night?" Meaman affected perplexity. "I'm afraid . . . What matter did we discuss, Mr. Cooper?"

"The new Royaltechs preferential share issue. You remember, surely? A million shares at par you told me, for selected investors. I'd like to inquire further about the offer and . . ."

"Ah, now wait, Mr. Cooper, wait," Meaman said quickly. "You must be in some error. These shares are not for sale to the general public. They are more or less for private subscription. You see, we have no need to put them on he market. The demand quite adequately covers the supply."

"Oh?" Cooper was taken aback. "You assured me last night that a number would be available to outside purchasers. In fact," he said, rallying, "you told me that it would be a good opportunity if I wished to buy in."

"What? I told you that? I couldn't have." Meaman feigned retrospection masterly tinged with

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doubt. "That was in the club, shop talk. Surely you don't intend to take advantage of conversation held in such relaxed and informal circumstances? Believe me, I had no intention of conveying the impression that such shares were for sale. I am sorry if you got the wrong idea."

"What?" Cooper scowled. "I had the distinct impression that a portion of those shares was available, that you were, in fact, looking for a buyer. And furthermore," he said, warming, "you promised to give me first consideration if I wished to invest."

"I promised you *that?*" Meaman looked surprised. "Surely not." Defensively he said, "Mr. Cooper, I go to the club to shed the cares and worries of the day. I like a good bottle of wine and good company. A man should not have to be on his guard in such surroundings. If in a convivial mood, I let slip one or two facts to my companions of the time, you can understand that such revelations should be treated with discretion." Meaman worked up a patent smile for Cooper. "I'm sure that you understand the position and, as a gentleman, will not press to bind me to any statement I may have made in a casual moment."

The toothily placating visage did not spur Cooper to nobility. "On the contrary," he said. "You promised me an option if I wished to take it up. And I am very much interested. If the shares are available, I see no reason why I should be denied an opportunity to purchase."

Meaman's phony beneficence disappeared. "They're *not* available. They're spoken for—all earmarked. As I said earlier, we'll have no trouble filling the remainder of the offer. Really, Mr. Cooper, there is nothing to spare."

Cooper stuck out his lower lip. "Now see here, I won't have this. Last night it was a straightforward proposition and you were advising me to buy. You told me to call and talk it over and I have. Now you're trying to back out. Are the shares for sale, or aren't they?"

After an apparent inner struggle Meaman adopted an ingratiating air. "Look, I'll tell you what I'll do. I'll put five thousand aside for you, how's that?"

"Five thousand?" Cooper glowered from the screen. "You said there was a fifth still to be picked up. You said I could claim a hundred thousand if I was quick."

"What?" Meaman was alarmed. "Oh come now, you wouldn't . . . Mr. Cooper, really, on such short acquaintance . . . You cannot expect to hold me to . . . to words that were spoken in jest more than anything else."

"I was not under the impression that you were joking," Cooper said tightly. "And in matters of business I am always quite serious. If the shares are there, I want them."

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"But . . . But . . ." Meaman searched his mind unhappily. "A hundred thousand, Mr. Cooper, that's . . . that's half the remainder of the issue. There are others . . . Look, I'll tell you what I'll do, I'll let you have twenty-five thousand." He beamed unconvincingly. "Minimize your risk. The expansion program *could* go wrong you know."

"I want the hundred thousand," Cooper said, adamant now. "Every one."

Meaman lapsed into crossness. "You are being unfair, Mr. Cooper. You are abusing a confidence and exploiting an incautious word." His jaw set. "I'lll let you have fifty thousand."

"A hundred thousand," Cooper insisted.

Meaman reddened angrily. He agitated the papers on his desk. "Mr. Cooper, you . . . you . . . Hmph!" Stiffly he said, "Very well. Very well. All right." His attitude became one of attempted disdain. "You can have them then." And Meaman added with an inflexion of nastiness, "We shall expect your certified check by nine o'clock tomorrow morning, otherwise your priority will be voided."

"You'll get it," Cooper promised confidently. "Just be sure that there are no mistakes."

Coldly Meaman said, "There will be no mistakes. If that is all you require, Mr. Cooper, I have other pressing business to attend."

"I shall expect confirmation," Cooper said.

Meaman raised an aloof eyebrow. "You will be notified in due course. Will that be all?"

"Ah." Cooper looked warily triumphant. "I guess so."

"Then good-bye," Meaman said, and with a brusque gesture he broke the connection.

"*Phew!*" Meaman smugly rubbed his hands. "What did you think of that then, Ferdy my boy? Your old uncle is in fine form, hey?"

"Uh, well, I don't get it, Uncle Syg. You're not the Managing Director of Royaltechs, are you?"

"Oh, yes, I am. It's listed as a privately owned company." Meaman stood up to walk around and pat the monitoring frames. "Modern gadgets are marvelous. My whole empire is here on tape. At the touch of a button my answerphone service can convey a world of bustling industry and thriving enterprise. From a dump like this. A new toy of great promise. And it's so simple."

Meaman pushed a lever to place the system on automatic. "I don't think he will call back, but if he does I'll be unreachable in conference. Come, Ferdy, let us have an early lunch to celebrate the fund-raising capacity of my latest venture."

Ferdinand rose. "Uncle Syg, was all that legal? Are you really selling him some shares?"

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"My dear boy, the shares are nonexistent. No point in it. If they did exist, they would be worthless." He thumbed the door open. "Why take extra risks and add printing costs?"

"But isn't that against the law?"

Meaman ushered the young man into the elevator. "There is always a gamble in buying shares. Cooper buys mine and loses his money. He could buy genuine shares and still lose his money. Either way reveals poor judgment. But you will note that I did not sell him—he sold me."

"Yes, but with the genuine article at least he'd stand a chance. As it is, if you get caught you'll be sent to jail."

"I don't think so," Meaman said. "Cooper is equally at fault. Greedy."

"But when he finds out he'll sue you, won't he? You'll be a wanted man."

Meaman led the way from the elevator into the foyer. "I doubt it. Seeing me put away will have no financial return. If Cooper keeps his mouth shut, he'll get half his money back—through suitably documented channels, of course. In his place what would you do? You'd cut your losses and be glad to do so."

Meaman skipped to the up-half of the pavement. Ferdinand nimbly joined him.

"We are living in a highly technical age and, frankly, the more complicated it gets, the more I enjoy it," Meaman continued. "Some people can't keep pace and it bothers them. It doesn't bother me. The big secret to remember is that machines are only as perfect as the people who run them . . ."

They stepped off the pavement and into the aircar station.

There was a queue. Meaman walked to the front, Ferdinand at his heels. An empty air car rolled forward. Meaman flipped open his wallet at the man leading the queue. The man had a glimpse of worn embossed metal. "S.P.A." Meaman said flatly. "You'll have to get the next one."

The man looked mildly hurt but did not protest.

Meaman and Ferdinand ensconced themselves in the commandeered aircar and Meaman struck the selection for Capitol Square.

"What's the S.P.A., Uncle?"

"I haven't the faintest idea," Meaman said carelessly, "but it comes in handy at all sorts of places. Even gets me a box at the opera. Better than a ticket. Can go backstage with no trouble."

"But it must mean *something*."

"Oh well, I suppose it does, but I can't read Spanish. I picked the badge up in a pawnshop. Nice little case and everything. Came from Peru I think the proprietor said. From what I can make out it was an award for winning some ball

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game or other. Very stylish, I was taken with it straightaway."

"But Uncle, that's fraud. You can't pretend to be someone in authority when you're not."

"Why not? And who is? All I do is flash the badge and say 'S.P.A.' I don't explain it. I don't pretend to be a law officer or anything. Just flip, S.P.A., and in. I grant that the implication is there, but I leave the actual interpretation to the viewer. If I were questioned," Meaman said offhandedly, "I would naturally admit the truth—but nobody ever asks."

"Your bulk can be rather forbidding," Ferdinand observed.

"Ah, yes. Physical weight and the correct bearing all help. You see, it is a matter of training, and people are so used to accepting the ordering of their lives. It is so well known that it is useless to argue with authority that Mr. Average is pre-conditioned to suffer any time he meets with it. Or what looks like it. Mr. Average is bluffed and, to the good fortune of my career, is unaware that he is far from helpless against automation. Behind every machine is a human being, and human beings are as vulnerable as they ever were."

The aircar scooted along a two-way ledge ten feet over the street. It slowed at an intersection to fractionally avoid another crossing in front, sped on to round a corner, to pause, to cross the track and drop down into the busy Capitol Square aircar station.

Meaman and Ferdinand came out to take the anti-clockwise conveyor; changed pavements at the corner.

"In this scientific age," Meaman said, "there is one science that is sadly neglected. This is the science of dealing with science, the technique of employing the informational overburden of bureaucratic data processing to achieve individual sustenance and gratifying personal gratuity."

"Manipulating the books on a grand scale," Ferdinand said.

"Um? Yes. Yes, well put." Meaman shrewdly assessed the younger man. "It's a battle of wits. Very, very interesting. Absorbing, really."

They had reached the Cornucopia and here Meaman dexterously stepped off. "Ah. They carry an excellent menu here, so I am told. Come. Here we shall, if necessary through the obliging ambiguity of the S.P.A., obtain a quiet table and reasonable service . . ."

"What did you think of the Joachim Valley Liebfraumilch? Excellent vintage. Was a good year, '77." Meaman pushed away the jagged remnants of his grilled lobster. He wiped his hands on his napkin. "Where was I?"

Ferdinand dabbed at his mouth. "You were telling me of your early years."

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"Ah, yes, so I was . . . so I was."

The waiter removed the debris; served *hombe au chocolat* for dessert.

Meaman delicately appropriated his utensils. "We don't think. People are creatures of habit. Here we are eating food in a restaurant. We will get our bill, we will reach for our wallet automatically. Habit. We are in a rut. We can afford to pay but, when you come to think of it, this is a very dull and ordinary thing to do."

"Don't you normally pay for your meals?" Ferdinand said through a mouthful of cold fudge.

"Uh, yes, well, in a way, but that's just it, don't you see? It is familiar, customary and," Meaman said, "totally unexciting. I haven't thought of it before, but that is what habit does for you, makes you blind."

"You, uh . . . you're not going to, uh, break the habit right now, are you, Uncle. I mean, personally . . . "

"Ferdy lad, couldn't you see it as a challenge to your ingenuity?"

"But what for? We've got money, haven't we?"

"Oh dear, oh dear." Meaman sucked in a last spoonful and said, "My boy, experimental money-saving opportunities should always be explored. Only way to find out. Like the time I used two different inks to boost my bank account. An idea has to be put into practice, to the test."

"Two different inks, Uncle?"

"Yes. No fruit for me, thank you, but I would like some Danish," he told the waiter. "And I think some Grand Marnier with our coffee would round things off rather nicely."

Meaman came back to Ferdinand. "Gave a new wrinkle to an old idea. Had one ink that disappeared completely after a few hours, and another ink that, like a negative, took some hours of darkness to develop. I could pay in twenty dollars in cash near closing time, and overnight the pay-in slip would grow to two hundred dollars. Then a friend next day would present my check for two hundred dollars and it would bounce, whereat I would go to the bank and kick up a fuss, and they would discover their 'error' and apologize, and off I would go to write my friend another check for two hundred dollars. He'd collect the money near closing time, and by next day the check would have altered to twenty dollars, see? Oh lad, I'm telling you, we had enormous fun with that."

The cheese and liqueur brandy arrived and Meaman busied himself with the prong. "Marvelous number of variations you can get on a thing like that," he said. "Mixing in other accounts, and subtly keeping a balance in odd cents to make it look as though a decimal point has been misplaced somewhere."

Ferdinand waved the cheese

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away. "But Uncle, didn't they find out about it?"

"No. It was a glorious mystery. And because I have an excellent appreciation of sufficiency the discrepancies remain a mystery to this day. The ink still comes in handy on forms, though. Gets them past the rubber-stamp stage." Meaman popped a piece of biscuit into his mouth and munched. "Banks are a very good challenge. Photo-checking does not make them foolproof. It is when things are so well protected that it is diverting to exploit a flaw." He took a sip of liqueur and then a mouthful of coffee to spread the flavor.

"Uncle," Ferdinand said, "uh . . . do you think it's right to do things like that? Aren't you afraid of the consequences? I mean, ordinary people don't behave like that, do they?"

"No, thank God. Ordinary people are ordinarily dumb. As for consequences, I've pretty well covered myself for any eventuality. I have packed my life to cover all the angles I can conceive."

"But the angles you have seem to be mostly illegal, Uncle."

"Social mores and taboos are very constricting. Convention is convenient, convenient to the plodders and, happily, convenient, in another sense, to me. I am fortunate in being a person who can flout custom in a manner that alleviates tedium and puts some hum into the humdrum."

Meaman finished his coffee, used and discarded his scrunched napkin. "Now then, how are we going to avoid paying?"

"What? Uncle, you're not going to be lousy over a few dollars, are you?"

"Tish," Meaman chided. "It's not a question of being lousy. It's the principle of the thing." He patted his tum. "Any fool can pay for a meal, but to obtain a free lunch by the employment of guile and wit, ah, what an aid to digestion such enterprise would be.

"Think, Ferdy, think," Meaman admonished. "There must be a thousand ways that such an objective may be accomplished. We could simply walk out, but that would be cheating. We must have performance, interaction. If you surreptitiously stuck your fingers down your throat and threw up, I am sure this event could be resolved into the waiving of our joint bill. Sickness is always good. If one or the other of us was to lurch to the floor and roll about as in agony, in a short space the matter of our check would become secondary."

"I," Ferdinand stated firmly, "am not going to roll about on the floor."

"Hm-m-m. You want something less histrionically flagrant. Pity. Well then, we could both leap on that timid little fellow over there and arrest him, say he is a notorious bigamist and wheel him out os-

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tensibly to be charged. That way *three* of us would get a free meal."

"Uncle, please, just let's pay, huh? I'm not used to this kind of thing."

"Ah, Ferdy, you don't know what you miss. Your father's inhibitions have rubbed off onto you. You are too staid, adhere too much to the conventional sense of fitness."

"Perhaps so. I'm not, well, sort of prepared. I'd rather we just played it straight this time, if you don't mind, Uncle."

"Oh, very well." Meaman reached into his pocket, pulled out half-a-dozen wino-dino cards, selected one. He looked at it. "Yes. Symon Meenan could do with having his expense account filled out." He raised his hand. "It is better to employ assets than money. Check, please."

"Is that a legitimate card, Uncle?" Ferdinand quizzed after the waiter had departed.

"Paperwork, my boy, all paperwork," Meaman replied. "Just a matter of keeping the accountants happy."

"But, well, someone will have to pay, won't they?"

"Believe me, lad, it gets lost. They have a reserve fund especially to cope with that kind of thing. And if the fund is there, why not use it, eh?"

"I've never thought of it like that."

"Well, you should. There's any amount of reserve cash just waiting for a correctly filled form to arrive."

"I don't think I could do it," Ferdinand said. "Convincingly make out a false claim, I mean."

"Nonsense," Meaman declared. "Anyone could do it with a bit of training—the right approach, the right attitude. It's easier than you think."

The waiter returned with Meaman's card. Meaman added a tip to the bill and signed it. He and Ferdinand stood up to leave.

"I don't think I'd have the nerve." Ferdinand said. "If *I* did it, *I* wouldn't be able to get away with it."

"Nonsense," Meaman said again. "Started off right, modestly, with some basic tuition, you'd pick it up in no time."

"Do you think so?"

"Ferdy lad, I know so. What do you do for a living?"

They stepped out onto the pavement. "I'm in records, at Runsell's O and P. That's, uh, where I came across your name and, uh, well, I thought I'd look you up. You don't mind?"

"You were lucky to catch me there." Meaman sniffed. "Records. Is that how you want to spend your life?"

"Uh, well . . ." Ferdinand looked uncomfortable. "It's not much, really. I *would* like something that was more . . . more in-

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teresting. You know, where a man could make, well, some of his own decisions."

"Ferdy, you did the right thing coming to see me. You're not as silly as you pretend to be," Meaman said perceptively.

Ferdinand started. "Oh? Most people don't think I'm too bright."

"Yes?" Meaman smiled. "You don't fool me. An affinity of blood, I suppose. The first moment I saw you I was struck by your ingenuousness. You do it very well."

"Do you think so?"

"Would fool most people." They changed pavements. "But you look so much as I did at your age." He sighed with nostalgia. "I noticed the family resemblance immediately. Why did you *really* come to see me?"

"Oh, well." Ferdinand decided to take the plunge. "Dad is so stuffy and, I don't know, I'm restless, I guess. There should be more to life than . . . Well, whatever they say about you, you are obviously prospering."

"Ah, yes, and that's what every young man wants to do, isn't it? Ferdy lad, you impress me agreeably. Your old uncle is not indifferent to the priority of kin. Why not stay with me for a while? Maybe I could show you a trick or two you might find helpful."

"I'm not sure." Ferdinand was a well-brought-up young man tempted. "I might not have the aptitude."

"Give it a try," Uncle Syg said bluffly. "We can soon find out . . ."

Ferdinand, in fact, did have a surprising aptitude, and in a comparatively short time he grasped the fundamentals of the form-filler's art. Soon he was living on his own acquired credit cards, had the latest model floater under a change-over deal to a nonexistent company, and had an excellent free apartment in a large block from a landlord who had no wish to face numberless filed public complaints under city building ordinances. (Great scope there, from A to Z, with sub-sections, sub-sub-sections, and sub-sub-sub-sub-sub-clauses, et cetera covering everything from one nail per 3 IxI¼ roofing tiles, to the length, diameter and composition of the basement drainpipe. Not that there needed to be anything *wrong*, but the time and trouble to prove it!)

Yes, sir, indeed, Ferdinand was an able pupil, with a natural perspicacity that made Meaman warm to him more and more.

In a few months Meaman had to admit that the boy had acquired a polish that was equal to his own, had absorbed Meaman's years of experience with a ready acumen that Meaman was pleased to regard with consanguine pride. Meaman felt that he was passing on a heritage.

"Well," Doby Pinsher said, pulling his nose grumpily, "superficial-

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ly it would seem that Sygnet Meaman is the greatest menace to society since Attila the Hun. He is an actor of consummate ability, but above all he is a wizard with forms. He fills them in like crossword puzzles."

Pinsher grimaced. "He could be a success in any legitimate occupation he might care to pursue. However, he prefers to be a success in less savory enterprises." He riffled through the heap of reports he had received over the last six months. "He has no scruples whatsoever. He has obtained the old-age pension three times by spurious devices, has been on welfare as a Negro, as an illiterate Ukrainian, and as a bankrupt millionaire. He has claimed and been paid insurance when at times he has not even had a policy, and he has twice been officially buried, once having his remains shipped 'home' to Bulgaria. The man is a born mischief-maker."

"He's, uh, well," Hubert Rakely shrugged, "yes, he, uh, does seem to have a knack, sort of."

"An adept disorganizer and swindler." Pinsher complained. "He hasn't paid taxes for ages, yet every year he's been getting more rebate than a drought-stricken farmer." This rankled. To Pinsher this did not seem at all fair. "Allowances, refunds, registrations, statistics, polls surveys—even passports! Did you know that he was born in Vitoria, in Brazil? And that he is also on file as being a French used-appliance dealer? And also is the fourth son of a Masai king? And on paper he can prove it!"

"Yes." Rakely nodded. "It's gone so far that it will be difficult to *un*prove."

"Yes." Pinsher nodded, too, in glowing-eyed disgust. "That thing he did with the returned punch-card invoices that he made up himself—he padded his own credit and threw in a couple of hundred dummy statements cunningly cross-matched to cause the utmost confusion. Those cards got in everywhere and tangled the whole system to hell and gone. The supervisor went out of his mind. And here is Meaman, the cause of it all, an incorrigible schemer towards disorganization—here *he* is walking about scot-free. And what, I ask you, might he not do next?"

"Surely we have enough evidence now to put him away for life?"

"Sssschnett!" It was a ha-ha snort of bitter mockery. Pinsher scooped up the heap. "This?" He hurled the lot at the wall. "Useless. We can't touch him." His breathing was heavy. "We don't dare touch him. His devilishly maniac flair for authentic-seeming form-filling has created a nightmare world where inter-departmental checking to sort out and define just what, where, when and how he has transgressed, and if, would take years of toil. Because he wouldn't hold still, would he? He'd make proof as we

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were getting proof. And proof is on facts, which have to be checked with other facts, which have to be proved with more facts, which have to be checked, which . . ."

Pinsher leaned on his desk. "Short of murder, it just wouldn't pay to arrest him. Bureaucracy is a delicate thing, and he has infiltrated it in the most comprehensive and diabolical way. Questioned on one thing, he can cite another. Who questions legitimate-looking forms?"

"Meaman is known. He exists. He exists everywhere. No man has ever existed so often so officially in so many files. Not since Kilroy has a man been so positively ubiquitous. We can't book him because he is so many things to so many departments. It wouldn't be wise to ticket him for a minor breach even. You must remember that he can prove that he is dead already. Twice. And he can play a tune on his foreign citizenships and maybe cause an international incident.

"It's on the books, see? It's listed. It's official. He's got himself there, in so many places, and to straighten out the records now would take mountains of red tape and upset so many people that, for the sake of the tenuous order we now have, it . . ." Pinsher waved helplessly. "What can we do?"

"Well, I have an idea. I've been giving the matter some thought," Rakely said. "Devices have uses. Things intended for good can be misapplied for ill. Why can't things conjured for bad be realigned to serve good purpose?"

"What do you have in mind?"

"Well, it'll be cheating really, but it would be one way to insure no cross-references. With him I think we'd be justified. Something to hold him for a couple of years or so while his, ah, estate is gone into . . ."

"Ferdy, my boy, why are you escorted by these overlarge and unyielding gentlemen?" Meaman sounded hurt. "Don't tell me that you made an error in your declaration for exemption from service?"

"Oh, no," Ferdinand said. "These boys," he indicated the two very solid military policemen, "have come for you."

"For me? What in heaven's name for? Ha-ha. You're having a little joke with your uncle, right?"

"You could say that," Ferdinand said cheerfully. "A permanent joke. You are a deserter from the army."

"What? Rubbish! I never was in the army."

"In an application for a home loan, you quoted veteran's privileges."

"Yes, but a veteran of what was not specified. Plus, backing collateral was provided by an issue with Baukers & Baukers, and you can check my references through them."

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"We have. These led to Skags & Walkden, who went into voluntary liquidation, and to Tyonkins, Inc. These two in turn took us to the Blaine Street Personal Security Office, the Tookley Employment Bureau, the Korsenheit Foundation, the Registered Company of Entrepreneurs, and God knows where else."

"There, you see?" Meaman said complacently. "What are you trying to do? Having a little game? A test, eh?"

"You could say that. Looking for weaknesses. The weakness, of course, is that you play by yourself. Now, the protective skein you have woven is to interminably enmesh *civilian* law in the event of prosecution. *Military* law, however, is a different thing entirely. And the Army never forgets. At a court-martial the introduction of civilian sidetracks is considered frivolous. As a deserter, and under fire, too, concern will be for the major issue. Anything else would be incidental."

"But I was never in the army," Meaman reiterated. "How can I be a deserter when I have never even joined?"

"Well, by some strange coincidence, your application form and acceptance are on record, plus applications for leave, transfer, promotion, et cetera. Plus your front and profile and fingerprints, of course. Clear cut. No extraneous attachments. And finally traced. It's all on file, so it can't be wrong. And, as I have said, once the military have you, your civilian doings will be of no moment. Very jealous of its prerogatives, the army."

"Ferdy! What have you done?"

"Oh, just filled in a few forms that you knew nothing at all about. Have a lot more to fill in while you're away, too. Next of kin, you know—have to tidy up your affairs. There is proof that you are dead, isn't there?"

"Ferdy, no! How could you do this to me? After all I've done for you!" Resentfully Meaman said, "You want it all to yourself? Wasn't there enough for both of us?"

"Yes, well, I suppose there was. But there are two facts that you are unaware of. Your nephew Ferdinand had his birthmark removed a long time ago. Secondly, I am employed by the Federal Agency."

"Oh."

"Your trial is to be held in Alaska, I believe. Don't forget to take some woolies along, ah . . . Uncle . . ."

"Since Capone the big, bad boys have been careful to pay their taxes. Generally speaking, though, they don't fill in enough forms. However, like everybody else, they're careless with those they do fill in. See these from that arch villain Veldez de Locca? Spaces skipped in sections that don't apply.

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Thoughtless," Hubert Rakely—alias Ferdinand, as if you didn't know—said. "Now, if we were to fill in some of those spaces with appropriate misinformation, we could send him query forms each demanding an accounting for a certain aspect. His ignorance and subsequent reaction should give us enough material, if carefully handled, to move into full-scale bombardment.

"There's nothing quite like the minutiae of bureaucracy for driving a man mad. It happens accidentally at times to ordinary people, so why shouldn't we purposely help it happen to de Locca? As a weapon it can't really be called illegal and, judiciously managed, we should be able to cross-tag him through the system and bog him in a mass of official documentation. It will save us looking for evidence to deport him, because likely enough he'll deport himself.

"Then there's Joe Fingerman Gaston. Now, *his* legit front is woven materials. As I see it, his import licenses leave him wide open, not to mention . . ."

Bureaucracy, after all, is best understood by a thoroughly trained bureaucrat. ■

In Times To Come

Next month's issue starts a new novel by a familiar author; "Wolfling," by Gordon R. Dickson.

Gordie Dickson tends to write shorter pieces—but with a story to tell that has the sweep of time and space involved in this one, even a full novel is a cramped form for the action that builds the tale.

When the Roman Republic degenerated into the Roman Empire, and the madness and cruelty that shoddy Empire became—men had little choice. Rome was the only civilized nation in the known world; you might loathe it, be disgusted by it—but where could you go, what choice did one have?

With a Galactic Empire, with more millennia of history than Rome had decades, and a technology too high for any barbarians to touch . . .

Getting out of such a necrotic Empire would be impossible.

The "Wolfling" wasn't a barbarian invader—quite. But his welcome to that Empire was about what a barbarian from the Outer Darkness—a place called Earth—could expect!

THE EDITOR

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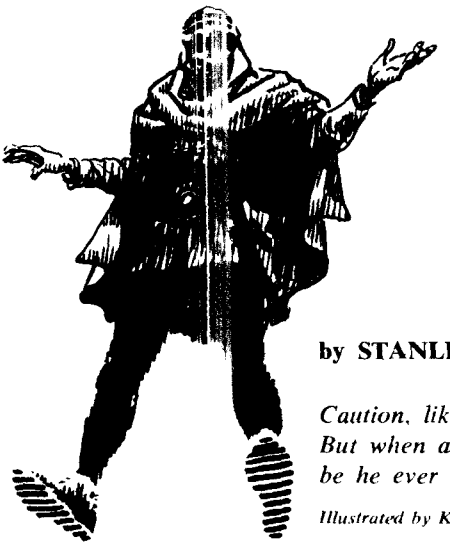

by STANLEY SCHMIDT

Caution, like anything else, can kill or cure. But when a bureaucrat exercises it by the book—be he ever so alien—it usually brings ruin!

Illustrated by Kelly Freas

The Reluctant Ambassadors

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The intercom buzzed once. Roger Pelland, captain of the *Reunion*, touched the stud to see who was reporting.

It was Randolph. The picture that formed on the screen made that obvious, but did not exempt the Nav-Com officer from reporting: "Navigation and Communication Officer Randolph reporting, sir." Then, much less formally, "Captain, there's something out there!"

Pelland frowned sternly. "Impossible!" he snapped, before he thought how incongruous the word was, coming from him.

"I thought so, too, sir," said Randolph. "But there it is. Just a pinpoint, but it's been sitting there for at least five minutes. I thought I should tell you. It's in Screen 4, near center."

Pelland was still scowling. There was enough novelty in this trip to suit him without any completely unexpected phenomena. He said stiffly, "Thank you, Lieutenant. I'll check on it." He touched the stud again and Randolph vanished from the screen.

Pelland activated his nav-screen extension and selected Screen 4. It was black and featureless, of course, like all the screens when they were traveling faster than light. He was about to switch the viewer off and reprimand Randolph when he saw it.

Just left of center, a tiny dot of light glowed faintly but steadily. It was too small to show any shape, but it was definitely there. And it shouldn't have been.

He was still staring at it when he heard the door open and close behind him. He turned to see that Angus Gunther, the "watchdog" from the ECC, had entered uninvited. The irritating little civilian wore an expression that was half smile and half sneer as he strode to join Pelland at the viewer. "Well, Captain," he asked suavely, "what is it?"

"I don't know.". .

"I was led to believe," Gunther went on deliberately, "that Kokes's 'kinetic barrier' separated two worlds, or some such gibberish. That objects going faster and slower than light could not see each other."

"That's what we thought."

"Yet there's something out there." Gunther's manner was oily and faintly derisive. He mused, "And none of our authorized ships are anywhere near here . . ."

"We're working on it," Pelland interrupted bluntly. "Now unless you have some useful news, I'd thank you to leave my cabin."

The ECC man stared at him peculiarly. "As you wish," he said quietly, and then he left.

Pelland watched the object for the next hour. It never changed visibly, and he never figured it out.

Then they tunneled and the stars came back, in such dazzling profusion that no one could tell whether the object was still there.

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But it was still very much in Pelland's mind.

Paul Benson rocked slowly on his porch, watching the Big Sun rise and the Little Sun set. The Little Sun had not quite vanished below the hills of the western rim of the Valley, and the Big Sun had not quite risen above those in the east. At this moment the sky flamed with nearly equal intensity—but slightly different hues—on both sides of the Valley. Never before, in the thirty years since he and his people had settled here, had conditions been right to see such a sight.

Already the younger men, clad like Benson in long, shiny white burnooses, were setting off for their day's labor in the fields. Seeing them reminded Benson forcefully that the conditions which let him witness spectacular sunset and sunrise at the same time were not an unmixed blessing. He did not envy those men. This early in the morning, the temperature was hardly more than 90° F. But in an hour, and almost until the Big Sun set, the burnooses would be essential protection against the heat. When he had been young enough to work in the fields, he had never had to contend with such conditions.

Sudden awareness of a distant drone distracted him. It was one of those strange ships, of course—but there was something subtly different in its sound. It was coming audibly closer, and Benson searched the sky, hoping to catch sight of it.

In a moment it appeared over the northern hills and soared out over the Valley, its noise suddenly much louder. Its path changed—it described a slow circle over the Valley, low enough so Benson could see that it was metal and barrel-shaped. He felt sudden apprehension—so far the aliens had left them alone,, but this deliberate circling over the Valley had ominous implications.

People, attracted by the noise, were appearing in front of all the houses and looking up at the sky. The ship was still circling—and beginning to spiral downward. Two more times around the Valley and it was only a hundred yards up. It settled over one spot, swung to a vertical position, and began to descend slowly.

Benson jumped out of his chair with an oath. Landing *in the Valley!* None of them had ever done that before, and he didn't like to think what it might mean. His heart pounding, he picked up his cane and carefully stepped off the porch. He started toward where the ship was landing.

The people in front of the houses had dashed inside and were coming out again armed with shotguns, scythes, and blasters. The ship was just settling onto the ground in the end of the Valley. As soon as it was down, its roar died in seconds to silence.

Paul Benson could only walk

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rather slowly, but those who were able broke into a run toward the threatening ship. In five minutes, nearly the whole population of the planet surrounded the intruder, waiting tensely.

Darryl Vintner saw to it that he was in the front of the crowd. He paced around the ship like a cornered tiger, ready to swing his shotgun into action on an instant's notice. The smoothness of the ship's skin made it impossible to tell where the door was, but he wasn't going to be far away when it opened.

He fumed as he looked again and again at how narrowly the strange ship had missed a field of vital crops. He had warned the Council repeatedly that they should take preventive measures before this happened, but Benson wouldn't hear of it. And now here was an unidentified ship in the Valley.

A ripple of tension through the crowd alerted Vintner and he looked up. A door had silently opened just above the central bulge in the ship, and a metal ladder was snaking down the side. Vintner moved swiftly to a point twenty feet directly in front of the ladder and watched anxiously. All those around him became quiet and looked up.

Nothing happened for about a minute. Then a humanoid form appeared just inside the door, apparently about to climb down the ladder. Vintner swung his shot gun to his shoulder, cocked it, and aimed in a single motion. Automatically he yelled, "Stop! Put up your hands!" and immediately felt foolish for doing so.

But the figure in the door, still partly hidden in shadow, stopped and raised its hands. Vintner blinked and loosened his grip on his gun. This wasn't at all what he'd expected. Confused, he shouted, "You understand English?"

"Of course!" a man's voice came back. Cautiously, the figure moved slightly forward into clear view. It was a man, just like the people of the Valley except dressed in a neat, light-blue suit of pants, short jacket, and cap, with metal ornaments on the jacket and cap. His expression was as puzzled as Vintner's—and Vintner was completely mystified.

The man looked over the armed assemblage and finally said, in very ordinary English, "I don't know what's going on here, but I guess I'd better introduce myself. I'm Captain Roger Pelland, of the United States Aerospace Force. There are seven of us aboard." He eyed the weapons again and added, "Our purpose is entirely friendly."

The situation was completely unanticipated and Vintner was unsure how to cope with it. He recognized the words "United States" and knew they meant this Captain Pelland claimed to be from Earth. But was he to believe that, and if so, what should he do?

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With relief he noticed Benson coming through the crowd. Benson was one of the Founders. He had come from Earth himself and would know better how to appraise the situation.

Vintner watched as the old man walked two paces in front of the others and stopped. He looked fixedly up at the man on the ship, saying nothing but wearing an expression which Vintner couldn't quite read.

Finally he said, just loud enough to be heard by the Terran, "So you've finally decided to pay us a visit. About time!" Then he turned and walked away as briskly as he could, telling Vintner as he passed, "He's telling the truth. Might as well let them down and find out what they want."

Vintner hesitated only a moment. Then he lowered his gun, and the others followed his example. "O.K." he called up to Pelland. "You can come down, but we'll be watching you. Welcome to Centaurus Colony."

The Centaurans quickly forgot their initial hostility in their eagerness to meet real live Terrans. As fast as the seven men could climb down the ladder, they were surrounded by Centaurans, especially young ones, overflowing with apparently friendly curiosity. Vintner only hoped the Terrans could forget their hostile reception half as quickly. Certainly it had been a poor way to begin an acquaintance, and an explanation was in order. Vintner invited Pelland to his home for food and drink, and was relieved when he accepted. Other Centaurans followed his example, and soon each man from the ship was going home with some person or family of the Valley.

As they walked across the dry ground toward the cluster of houses built around the *Mayflower*, Vintner began, "I must apologize for the way we met you, Captain Pelland, but nobody ever came from Earth before. When we saw your ship coming down, we just assumed it was one of the others."

"Others?" Pelland echoed, with an expression of surprise that startled Vintner until he thought how different this man's background was from his own. He must try to remember that there were people who spent their lives as farmers in the Valley, though he had trouble really visualizing anything else.

He said carefully, "Yes. The *Mayflower*—the ship that brought my parents—landed over thirty years ago. For reasons which I don't understand very well, no more came. I was brought up believing that there would probably be no more ships from Earth—that we were alone and on our own here. But for a long time now, other ships have been coming and going. Not right here, but not too far from the Valley, either—and coming closer."

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"Where do these other ships come from?" Pelland asked eagerly. Vintner looked at him and saw that his earlier wariness was gone. The captain was all curiosity now.

Vintner said, "We don't know. And we don't know why they're here or what they want. But some of us think they may be hostile. So when we saw your ship coming down in the Valley, we thought it was one of them—and we were prepared for the worst."

Pelland was plainly excited and so full of questions he wasn't sure which one to ask first. He also looked uncomfortably hot and was perspiring heavily. Evidently the Terran was unused to such weather, and he was obviously poorly dressed for it. Vintner would have to offer him salt and a burnoose.

They were at Vintner's house now. Vintner opened the door and let Pelland precede him into the living room, small but refreshingly air-conditioned by power from the *Mayflower*. The thread of their conversation was broken as Vintner introduced their guest to his wife and two small sons. Edith was obviously relieved to see Vintner back in one piece; Bob, the older boy, was intrigued by the idea of a man in strange clothes who came from another star, even farther away than the Little Sun; and Pelland took time to admire and play with the baby. It was half an hour before Vintner could resume telling Pelland about the alien ships.

They sat stretched out on the single couch, eating catlizard sandwiches and drinking glasses of a sort of cold beer made from the mop plant. Pelland asked, "Do you know who . . . or what . . . comes in these ships you mentioned?"

Vintner shook his head. "Not exactly. Although we've had a couple of glimpses of them, at a distance, from the hilltops. And once when I was hunting there were a couple of them hiding up there in the bush, apparently watching the Valley. We hadn't known they were there, but we must have scared them when we got too close, and they left in a hurry."

"What did they look like?"

"We didn't get a good look then, and the other times they were far away. But they seem to be roughly the same shape as people, with bright red skins and no clothes."

The look of intense interest was back in Pelland's face, and Vintner wondered if this man might be a potential ally. The Terran asked, "Do you have any reason to believe they're hostile?"

"Nothing substantial. Mostly it's just that we know so little about them. But those two did seem to be spying on us. And there have been a few unexplained cases of minor crop damage, and a cow disappeared once."

"How long has this been going on?"

"About fifteen years."

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Pelland seemed to choke on his beer. Then he echoed incredulously, "Fifteen *years*?" Vintner nodded calmly and Pelland continued, "You mean to say humanoid aliens have been coming here for fifteen years and you've had no contact with them?"

"That's right." Vintner now felt almost sure that this man was to be cultivated with care. He explained, "Some of us—mostly younger farmers, and I guess I'm sort of the ringleader—have been trying to convince the Council that we *should* try to find out who they are and what they're up to. If nothing else, we should find out if they're hostile before they get too firmly entrenched—if it's not already too late. But the Council is adamant—especially Paul Benson. They mumble things about 'Pandora's box', or some such thing."

He noticed the uncertainty on Pelland's face and added, "I should tell you about the Council. It's nothing as formal as the governments I've heard about on Earth. There aren't enough of us to need anything like that. We operate more or less by straight popular vote. The 'Council' is a group of half a dozen men and women, mostly Founders, who are generally looked up to. If they take a strong stand on something, everybody admits they're probably right and goes along with them. On this question, they're strongly against doing anything—Benson most of all. And Benson has plenty of prestige—he's the oldest man here, and he was the captain of the *Mayflower*. We've been reluctant to openly break with the Council—life is tough enough here so we can't afford splitting into factions. But we're afraid to just let this situation go on."

Pelland asked, "Is Benson the man with the cane who came out and looked me over right before you let us come down?"

"Yes."

"Where can I find him? I'd like to talk to him."

This is hard to believe, Pelland thought as he stepped back out into the searing heat, partly protected by the burnoose Vintner had loaned him, and set off for Paul Benson's house. He had always tacitly assumed that if and when two intelligent races met, both would be eager to strike up communication and learn all they could about each other. Yet here were two such races—both humanoid, even—that had been living side by side for years without ever speaking to each other.

Well—maybe *they* weren't interested, for whatever strange reasons, but he was. The *Reunion*'s broadly stated mission could easily be construed to include making contact with aliens, and the opportunity was one that Pelland could not pass up lightly.

And in the back of his mind was

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the suspicion that these alien ships had some connection with the spot of light they had seen beyond the barrier on the way here.

As he walked, he looked around at his surroundings. He wasn't sure just what he had expected man's only—known—extrasolar colony to be like, but this wasn't it. The whole thing occupied the floor of a valley ringed by moderately high hills covered with scrubby, gray-green vegetation. Most of it was open fields of similarly unattractive plants, irrigated by an unimpressive stream meandering across the valley. In the middle stood the garnished hull of the *Mayflower*, the big, old-fashioned ship whose crew had founded the colony. But she had not flown for years—now gray vines ensnared her base, and power lines radiated from her to the mere dozen small stone houses which surrounded her. Trying to analyze his feelings, Pelland decided he must have expected more houses, a less primitive overall aspect. Now he realized abruptly that he had no right to expect such things. He certainly was well aware that the colonial expedition had consisted of *two* ships, and that one of them had mysteriously vanished in midspace. A colony starting out deprived of half its manpower and equipment started with a severe handicap indeed.

He came to the house Vintner had described and found Benson in a rocking chair on the front porch, dozing. But as Pelland approached, the old man's eyes snapped open and recognized him at once. "Captain Pelland," he said in an extremely neutral tone, "what can I do for you?"

"I'd just like to talk to you for a few minutes, Captain Benson. May I come onto the porch?" Benson nodded slightly and Pelland stepped up into the shade, where it was only 109° F. "Sorry if we scared you people," he said. "We tried to radio you before we came down, but we got no answer."

"We've kind of given up on the radio," Benson said wearily. "There've never been any calls except the reports we traded with Earth every few years at first. So why have somebody listen?" He laughed dryly. "We even gave up those reports. Must be over fifteen years since we sent one. We realized finally that it wasted too much power to get a signal through the distance and noise to Earth. It had become pretty obvious that Earth had abandoned us, so we'd better save all our resources for our own needs."

This was no news to Pelland—authorities at home had begun worrying about the colony when the last scheduled report had failed to arrive, and it had been three years overdue when the *Reunion* took off. He said mildly, "You judge us too harshly. You weren't really abandoned. But when you people reported that the *Columbus* disap-

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peared without a trace in front of eyewitnesses, the Extraplanetary Commerce Commission decided we'd better try to figure out what happened before anybody else risked it. They may not have been right, but they meant well."

"That does us a lot of good," Benson said bitterly. "We came out here to start a colony, in good faith that additional people would be sent to help us. We lost half our expedition, so we needed reinforcements more than ever. In response to which the ECC decided nobody could come until theoreticians figured out how to explain something outside their repertoire. Earth has a very poor record, Captain—one interstellar flight, one partial failure, and they curl up and quit."

Pelland was uncomfortable. He hadn't come here to get into an argument about that. He said lightly, "Anyway, that's in the past. We're here now, Captain Benson, and if all goes well maybe you can get more colonists soon. A man named Kokes stumbled onto a faster-than-light drive that the ECC couldn't ignore indefinitely—though they tried."

That brought out the spaceman in Benson, and his face lit with interest. "Faster than light?"

"Yes. We used to think it was impossible because of relativistic effects—the energy needed to get anything to the speed of light seemed to be infinite. It turns out that it isn't, but it's higher than anybody could reasonably hope to reach. The energy as a function of speed hits a maximum at c—and then it *decreases* again. Zero kinetic energy can correspond to zero velocity—or infinite. The peak at c forms a 'kinetic barrier' analogous to the potential barriers that elementary particles occasionally tunnel through. Kokes found a way to make ships tunnel through the kinetic barrier. Once on the other side, it's easy to go much faster. We left home about two weeks ago and covered most of the distance in less than a day at a thousand times the speed of light."

Benson whistled and smiled slightly. "Well, when do the colonists come?"

"Soon, I hope. But the ECC's still cautious. The Kokes drive is more or less on probation. They've made some preliminary tests and now they've authorized four expeditions. Every one carries an ECC 'observer'—ours is a Mr. Gunther—who's watching eagerly for anything to go wrong so they can slap their ban down again. One of the things we'd most like to do is find out what happened to the *Columbus*, since that little mystery is the main basis for their fanatical caution."

"Good luck. We never even found a clue, and that was years ago."

Pelland shrugged. "We don't expect much, but we can hope. Aside from that, and maybe a little ex-

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ploration of our own, our mission is to reestablish contact with this colony and offer any help we can." He looked directly at Benson. "And the thing which seems to need our attention most is the question of the aliens."

Benson's smile vanished abruptly. "Have you been talking to Daryl Vintner?" he demanded sharply.

"Yes. It struck me as very odd that you people and the aliens have known about each other for so long and yet have had nothing to do with each other."

"Vintner is young and foolish," said Benson. "He wants to confront the aliens and find out what they're doing here. But that could stir up all kinds of trouble, and we're not prepared to handle it. There are only forty-nine of us, Captain. So far there's been no trouble. I say as long as they leave us alone, we should leave them alone."

"I see your point," Pelland conceded diplomatically, "with your small numbers. But I also see Vintner's point. The aliens could be preparing for something you'll suddenly wish you'd known about sooner. Or they may even be friendly, and if this second beginning of an interstellar era doesn't abort, we owe it to ourselves to get acquainted with other intelligences that we meet. I have a proposition, Captain Benson. The *Reunion* is better equipped than your colony to risk this. We would like to investigate the aliens. Cautiously, of course—for example, I'd like to try to follow one of their ships for a while if one takes off while we're here. What do you say?"

Benson shrugged, his face expressionless. "I can't stop you," he said.

"There it is," said Vintner, pointing.

Pelland looked. He had asked Vintner to show him where the alien ships landed, and Vintner had been more than willing. After warning his crew to be ready for a fast takeoff on very short notice, Pelland had joined the young farmer in climbing the hills to the east of the Valley. Gunther had insisted on joining them when he found out what was up. The climb had been exhausting, not because it was difficult but because of the extreme heat of early afternoon. Now it was over and they crouched among boulders at the top, looking out over another valley.

It looked much as the valley which sheltered the colony must have looked before the humans came. The same scrub-covered hills surrounded a scrub-covered floor. At a glance, there was no sign that humans—or humanoids—had ever been there. Not even scorched ground—but then, man had already learned to use subnuclear engines without devastating his take-off sites.

Vintner said, "They started farther away, but recently there've

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been frequent landings right down there. Not much to show it, though."

Pelland had brought high-power binoculars along. He slowly scanned the whole valley with them. Finally he offered them to Vintner. "I couldn't see anything," he said, "but maybe you can. I don't know what this land should look like, and you do."

Vintner took less time to scan the valley before he gave the binoculars back, explaining, "I can't see anything either, anyway out in the open. Of course, there are boulders and bushes down there. I suppose something could be hidden."

Pelland offered the glasses to Gunther, but the ECC man declined. He put them away and asked Vintner, "Has anybody ever gone down there to look around—when there weren't any ships, I mean?"

"No. That would be the surest way to infuriate the Council. Besides, you never know when a ship is going to come—and maybe some of them stay here all the time, underground or something."

Pelland decided not to press the point now, but made a mental note that a careful trip down there at night might still be a good idea. There seemed to be no gain in staying here now, so they stood up and started back to the trail down into the Valley.

They were just starting down when they heard the noise. Vintner stopped in his tracks and whispered tensely, "A ship!"

Pelland listened. He could believe the odd whine in the distance was a ship, but it was not quite like any he had heard. He turned around and whispered, "Come on. I want to watch it land." He hurried stealthily back to their hiding place among the boulders. Vintner and Gunther followed.

By the time they arrived the ship was in sight. Pelland felt his pulse clamoring as he looked up at it. It was the biggest ship he had ever seen. It resembled a squat bullet, almost comically broad relative to its length. As it flew over the valley it slowed, stood up on its flat tail, and sank slowly to the ground, its fall broken by some invisible cushion that no more than rustled the plants on the ground under it. Its whine died even as it descended, and it was silent when it finally stood on the ground like an ungraceful domed tower.

The humans waited. Long minutes went by and nothing seemed to happen. A couple of times one of them thought he heard some faint sound in or near the ship, but even that was very uncertain. Pelland wondered idly if the aliens were going underground directly through the bottom of the ship. through some portal that was skillfully camouflaged when they weren't using it.

Finally he turned to Vintner and

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asked very quietly, "How long do they usually stay?"

"Anywhere from a couple of hours to two or three days."

The lower limit made Pelland's decision easy. "We'd better hurry back," he said. "I want to be aboard the *Reunion* and ready to go when that thing takes off."

Vintner and all the Terrans spent the night sealed inside the *Reunion*. One or more lookouts constantly watched the outside world on the nav-screens and listened to it via the transmitter Randolph had planted outside. They were ready when the whine began and grew at dawn, and the *Reunion* was in the air within ten seconds after the awkward-looking alien ship rose above the hills. Pelland, Randolph, and the ship's computer cooperated closely to keep from either losing it or following too closely.

It took off with surprising slowness, accelerating at some 10G. Pelland's first reaction was to suppose that it had to go slowly in the atmosphere but would speed up out in the open. But it didn't. It held steady at 10G, and Pelland began to feel frustrated by the slowness of the climb. *Either they think they have all the time in the world*, he thought irritably, *or they're operating from some place mighty close by!* (Meanwhile Vintner, who had never been off the ground, had his eyes glued to the screens, obviously flabbergasted by the speed with which his native world was falling away below.

Less than half an hour out, the alien ship vanished. It went out like a light, only faster. Pelland and Randolph blinked in astonishment.

The "shock wave" hit before they opened their eyes again. The *Reunion* lurched violently, and the eight passengers were hurled to the floor and slid across it to the wall, almost leaving their stomachs behind. The unexpected surge ended as quickly as it had come, but an erratic "bouncing" took several seconds to die out.

Fortunately no one was hurt. Pelland frowned as he picked himself up. Nothing like that jolt should happen, and the pseudo-grav regulators should compensate for it if it did.

And the alien ship shouldn't have disappeared like that—but there was no trace of it in the screens.

That rang bells, somewhere. *Now you see it, now you don't.* A piece of Pelland's mind went to work trying to find an explanation for what had just happened, even as Randolph called him on the intercom.

"It's gone, Captain!" the Nav-Com officer blurted out. "Completely. I don't understand it. It couldn't have tunneled, could it?"

"I don't see how. It might as well try to tunnel from a dead standstill. We have to go up to 0.7c, and

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it takes us over two days at 100G. And we blur when we tunnel. Did that blur?"

"No, sir. That is, I didn't think so. It was just there one second and gone the next."

The very words one eyewitness had used in describing the Columbus's *disappearance,* Pelland noted wryly. He said, "I think we can assume that ship operates on a completely different principle. At the risk of getting in over my head, I'd guess it's some kind of 'space warp' That could explain the jolt we felt. If that thing warped space around itself—if you can picture what *that* means—and we were in the area that was warped, we'd feel it as forces. We felt forces, all right."

"We certainly did, sir. What do you plan to do?"

"Go back. It's gone and we have no idea where, but we can be fairly sure it's effectively beyond c. We can't get beyond c for days. We can't hope to catch it."

The manual details of changing course took only a few minutes. While Randolph took care of them, Pelland announced to all passengers that they had lost their quarry and were turning back. Then he turned to Vintner and asked, "Is that the only kind of ship you've seen them use?"

Vintner thought a moment and said, "No, there was at least one other. Smaller, I think, and built differently."

"I thought so." Pelland did not explain further, but he had a hunch the chase didn't have to end here.

And he had another hunch—possibly very important—that he wasn't going to mention to anybody yet.

Maybe he had found his clue.

Pelland and Vintner went into the aliens' valley that night. Pelland's original thought had been to use darkness as cover, but the darkness that developed was but a pale imitation. For after "twilight," Alpha Centauri B—the colonists' "Little Sun"—rose higher and higher in the sky, bathing the landscape in an eerie orange-tinted glow too faint to be called daylight but too bright to be called night. Pelland found the effect aesthetically pleasing, but would have felt safer under a dense overcast.

As they trudged up the hill Pelland found himself sweating. The Big Sun had set hours ago, but the temperature had not yet fallen below 90. He asked Vintner, "Doesn't it *ever* get cool here?"

Vintner laughed. "Sure," he assured Pelland. "When I was little, I never heard of a burnoose. They came in recently, when we started having hot seasons and somebody remembered they used to be standard apparel among some desert dwellers on Earth. We used to have seasons when everybody wore 'eskies'—suits designed to keep body heat in. I remember nights when it

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got really dark and hit 80 below."

"Sounds like you get plenty of variety."

"That we do. It's tied up with the two suns. We go around the Big Sun. So does the Little Sun, once every eighty years. Terran years, that is—we're not sure what to call a year here. The Little Sun's orbit is pretty eccentric, so it gets close enough to have quite an effect on our orbit and climate. Right now the two Suns are at their closest and we're almost directly between them. In just a few days 'midnight' by the Big Sun will coincide with 'noon' by the Little Sun."

Pelland was a little surprised at the native farmer's knowledge of astronomy, but since Vintner was a son of spacemen, it was not really very strange. Pelland said, "That reminds me of a question. Are you sure this planet's orbit is stable? You could have worse problems than bad weather if it isn't."

"My mother thought about that, too. She was navigator on the *Mayflower,* and she fed the problem to the ship's computer. It isn't stable—but it's stable enough. You can guess that the drifts are very slow from the fact that the planet has native life. Not much variety, I'm told—far fewer forms than Earth, and all of them rather crude hardy things which can stand big climate changes—but some of them are advanced enough so they must have been evolving for quite a while. People should be able to stand it for at least a few thousand more years."

At the top of the hill, they stopped among the boulders they had previously used as vantage point and looked into the neighboring valley. Seeing no sign of activity, they began to descend, talking seldom and in whispers. The going was slightly rougher on this side since there was no established path. It took them thirty minutes to reach the bottom.

Even at this close range they saw nothing unusual. Tensely, alert for any tiny sign of danger, they started to walk out across the valley floor. Vintner, being more familiar with the neighborhood, went first.

He had gone forty or fifty feet when he suddenly seemed to stumble. But he did not fall forward—he came reeling backwards, waving his arms to stay upright and stifling an involuntary shout of surprise. Pelland caught him, and then he was all right. "I ran into something!" he whispered hoarsely. "Something springy—but you can see there's nothing there."

"Let's have a look." They moved forward slowly with arms stretched out in front of them. Pelland felt it just about where Vintner had bounced. It was invisible, but impenetrable and resilient—and apparently harmless. Pelland poked around at it and finally decided, "A fence."

"A *what*?"

"A fence. To keep people like us

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out. The fact that they put it up implies there's something in there they don't want us to get too close to. The reason it's invisible, very likely, is that they'd just as soon not attract our attention in the first place. And it's harmless, I guess, because they don't want to make us hopping mad if we do bump into it."

"But—invisible? I don't like it. How do they do that?"

Pelland shrugged. "I don't know. We can't. But that's just a detail of technology. Come on, let's take a look around it."

"Mightn't it be better to go back? There's likely to be a guard."

"I doubt it." Pelland said with slightly more assurance than he felt. "The purpose of a fence is to make constant watching unnecessary. Since we've come this far, we might as well make sure there isn't an opening somewhere."

They followed the invisible wall around a long curve until it ended against a steep hillside. While Vintner waited, Pelland climbed up on the hill, still poking at the "fence" to determine its shape. As he suspected, it curved over the top, and he didn't have to go far before it was nearly horizontal.

He stepped out onto it. Vintner gasped, and Pelland grinned at him as he walked out a few yards, supported twenty feet above the ground by an invisible something with the consistency of a trampoline.

Satisfied that the fence was also a roof, Pelland slid down off it to rejoin Vintner. "O.K.," he said with a shrug that had no real resignation in it, "there's something there and we're fenced out. Might as well go back."

They returned to the colony without incident.

Two days later another ship came—and this one was the "other" type that Vintner had mentioned. It was a cylinder of the same bronze-hued material as the other, but considerably smaller—and its two ends were virtually identical. The sight of that symmetry sent a surge of satisfaction and anticipation through Pelland.

He and Vintner climbed the hills to look at the landing site again, but if there was any visible activity when the ship landed they were too late to see it. All Pelland got out of the trip was a still stronger conviction that his suspicion was right.

"There's another ship down," Pelland told Benson—who, no doubt, already knew—when they returned to the Valley. "We're going to try to follow this one, too. I thought you might like to go along."

Benson said slowly, "Your last one, I seem to recall, was a wild-goose chase."

"That's right," Pelland granted, "or anyway, so it seemed at the time." He didn't explain that, but

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went on, "This one may be a false alarm too, but I don't think so. I think this is going to be the one we catch up with—and find out about your alien neighbors."

Benson apparently didn't like the implications. He said, "I thought you were going to be cautious about this."

"We are—as cautious as necessary. How about it—are you coming with us? If nothing else, you can sample a ride on a super-c ship."

Benson looked thoughtful for several seconds, then asked, "Is Darryl Vintner going?"

"Yes. Captain Benson let me point out to you that if we succeed, the whole basis of this feud between you and Vintner is going to be gone. You'll have some kind of a rather new situation to adjust to, and you'll need cooperation to do it. Forget your battle with Vintner. An attempt *is being made* to find out about these beings and, as the acknowledged leader of this colony, you ought to be in on it. Especially if it leads to contact."

Benson was silent. He seemed to be pondering the possible near futures. The uncertainty of the last decade and more had been unnerving, no doubt, but they had been able to live with it. The prospect of its final resolution seemed to bring the uncertainty to a head. Learning once and for all where the aliens stood might reveal that all the vague worries had been groundless—or that the time for defensive action *had* been years ago.

At the end of a minute the old man had reached his decision. He stood up. "I'll go," he said.

At twilight the following day, after a long, tense wait, the sound pickup brought a low roar of engines being readied into the *Reunion*. Pelland had no idea how long the warmup would last, so as soon as he heard it he barked orders meant to be obeyed instantly. A faint low hum began somewhere deep down in the *Reunion*'s vitals. All occupants hurried to their take-off stations and glued their eyes to nav-screens.

Five minutes passed. With no warning, a sharp explosive sound burst from the pick-up speakers. On the screens, something blurred over the eastern hills and turned into a thin bright streak piercing the dusky sky.

Pelland triumphantly slammed a button on his panel. A faint sensation of motion came and went in an instant as the *Reunion* surged to maximum forward acceleration and the pseudo-grav simultaneously rose to compensate for it. Then there was nothing to show their motion except the planet plunging away from them in the screens.

Pelland climbed out of his safety harness and pressed a call stud on the intercom. "Randolph," he demanded anxiously, "are we on it?"

"Yes, sir!" the face in the screen

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assured him. "We have a perfect fix. It's a fast one, but I don't think it can lose us."

"Thank you, Lieutenant." Pelland switched off and settled back to wait with a grin on his face.

He kept in close contact with Randolph, following the alien ship's progress relative to their own with acute interest. The two ships seemed surprisingly closely matched, but the alien ship seemed to have a slight edge in power, and the gap between them widened slowly. Pelland watched that anxiously during the next two days—they could track at quite large distances, but, if the gap continued to widen, they could eventually lose the other ship.

It was an odd sort of tension to maintain. Basically it was the excitement of the chase—the fastest chase in human history to date, to Pelland's knowledge—but on a peculiarly intellectual plane. For the distances and times involved were such that no motion could actually be seen—or felt—with the pseudograv at work. Vintner seemed to feel that nothing was happening during those two days while Pelland worried that their quarry was getting away. Benson, the old space captain, kept himself entertained by asking Pelland detailed questions about the ship's operation—which, under the circumstances, did not remain perpetually entertaining to Pelland.

Pelland slept little and for short intervals. The third day he stayed close to Randolph in the main control room, watching the other ship under high magnification. They were still short of their usual tunneling speed—by over three hours—when the alien ship blurred.

Pelland had been afraid of that. He feverishly rechecked a mental calculation. They could do it from this speed, but it would be slower and less reliable than usual. But, if they didn't try, they would lose any chance of catching up with the ship they had chased this far. A fraction of a second after he began the chain of thought, he barked, *"Tunnel!"*

Randolph touched a button. A second later the instant of "disembodiedness," when everything seemed to vanish for a tiny part of a second, came and went. Then the nav-screens were black and empty, and the clock that corrected for relativistic and tunneling effects showed that more hours than Pelland liked to think of had elapsed in Earth's frame of reference.

Anxiously, he returned his attention to the screens, scanning them quickly but thoroughly for any break in the blackness.

He found it—a tiny dot of light in the third quadrant of Screen 2.

Just like the one that had puzzled them on the way to Centaurus Colony. Pelland felt a flash of triumph. "That's our rabbit!" he yelled, pointing at the tiny spot of light.

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Then he was off to the lounge where the others were gathered.

"You mean," Benson asked, "we've done it already? We're traveling faster than light?"

"Yes. With respect to everything else in the universe *that isn't also moving faster than light.*" Pelland grinned at the ECC man. "I figured this out not long after that little incident on the way out, Mr. Gunther, but kept quiet until I checked it." He addressed all of them. "All past experience with the Kokes drive—which isn't much—indicated that things going faster and slower than light are 'isolated' from each other, seeing nothing of each other. And things don't normally travel faster than light, so we didn't expect to see anything outside in super-c. But we did, on the way out from Earth. A spot—like that." He pointed at the screen.

"It bothered us," he went on. "It bothered me—until I realized there was a very simple explanation. The thing we saw was also traveling faster than light! And that, since things normally don't, immediately suggested a ship that tunneled through the c-barrier, like this one. That seemed to tie in with what Darryl said about an alien ship traffic. But the first ship we tried to follow acted in such a very unfamiliar way that I figured there must be another type also, more similar to ours. And there it is."

Benson was so caught up in the updated shoptalk of his old trade that he seemed to forget, for the moment, his opposition to their present mission. He asked eagerly, "What are our chances of catching up with it?"

Pelland shrugged. "Don't know yet. There's no known speed limit on either of us now. The race goes to whoever can accelerate the fastest on this side of the barrier. We don't know who that is yet, but we're doing all we can. We have our braking engines on as hard as they'll go."

Benson blinked. *"Braking?"* he echoed.

Pelland chuckled. "Oh, didn't I tell you? Plot up the c-barrier and you're forced to the conclusion that good old momentum conservation doesn't work so well on this side. That was one of the reasons the Kokes drive had so much trouble getting off the ground at home. The ECC's theoreticians were absolutely sure it was nonsense."

He caught a quick look at the expression on Benson's face and walked briskly out of the room, still chuckling.

Within two hours Randolph reported: "Sir, it's too early to be sure, but I think we're gaining on them."

Another hour and he was sure. When he reported this time Benson was in Pelland's cabin. Pelland heard the report and thought quickly.

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So they were gaining on the aliens. That meant the aliens were not "braking" as hard—either because they couldn't or because they didn't want to. In the latter case, their motives could be anything.

Pelland felt a brief twinge of the apprehension he knew had been bothering Benson. He suppressed that and made what he knew was most likely the rational decision. "Lieutenant," he said firmly, "I have a job for you. Try to contact that ship."

Across the room, Benson rose from his chair. On the screen, Randolph paled, gulped "Yes, sir," and disappeared.

Benson was clearly agitated. "Captain Pelland," he rasped, "you call this cautious? I thought you were just going to follow them, at a distance, and see where they went."

Pelland faced him directly. "Captain Benson," he asked quietly, "what are you afraid of? We're just going to try to talk to them."

"Will they know that?" Benson demanded. "What if they're unfriendly?"

"That's the risk we take. Do you really believe that's at all likely any more—after fifteen years? Your colony is a tiny, virtually defenseless agricultural village; they run huge starships in and out and put invisible fences around whatever they have there. If they had been interested in bothering you, they would have done it long ago.

"No, Captain, they're not out to get you. The more I think about it, the more convinced I become that this whole situation has been rather ridiculous. And everything I've seen of the aliens makes me think their reasons for avoiding you are quite as ridiculous—and innocuous—as yours for avoiding them."

Benson looked stunned. Pelland looked straight at him and finished, "I want to know the answers, even if you don't. And you know, you might get something quite unexpected out of my snooping. Maybe even those extra colonists you want." He winked slyly at Benson and left the old man to think before he could demand an explanation.

Harry Randolph wondered where to begin. Suddenly he'd been handed the job of making man's first attempt to talk to an extraterrestrial intelligence—a race he knew absolutely nothing about. Obviously, he had to send a signal. What kind of a signal?

Baffled, he stalled by doing the other thing that had to be done. He also would have to listen for a reply—and hope the aliens would reply by some means that something on the *Reunion* could detect. As a start, he activated a scanning receiver, programmed to automatically scan all normal communication channels and lock on any signals it found until told to continue scanning.

That took five minutes. Then he

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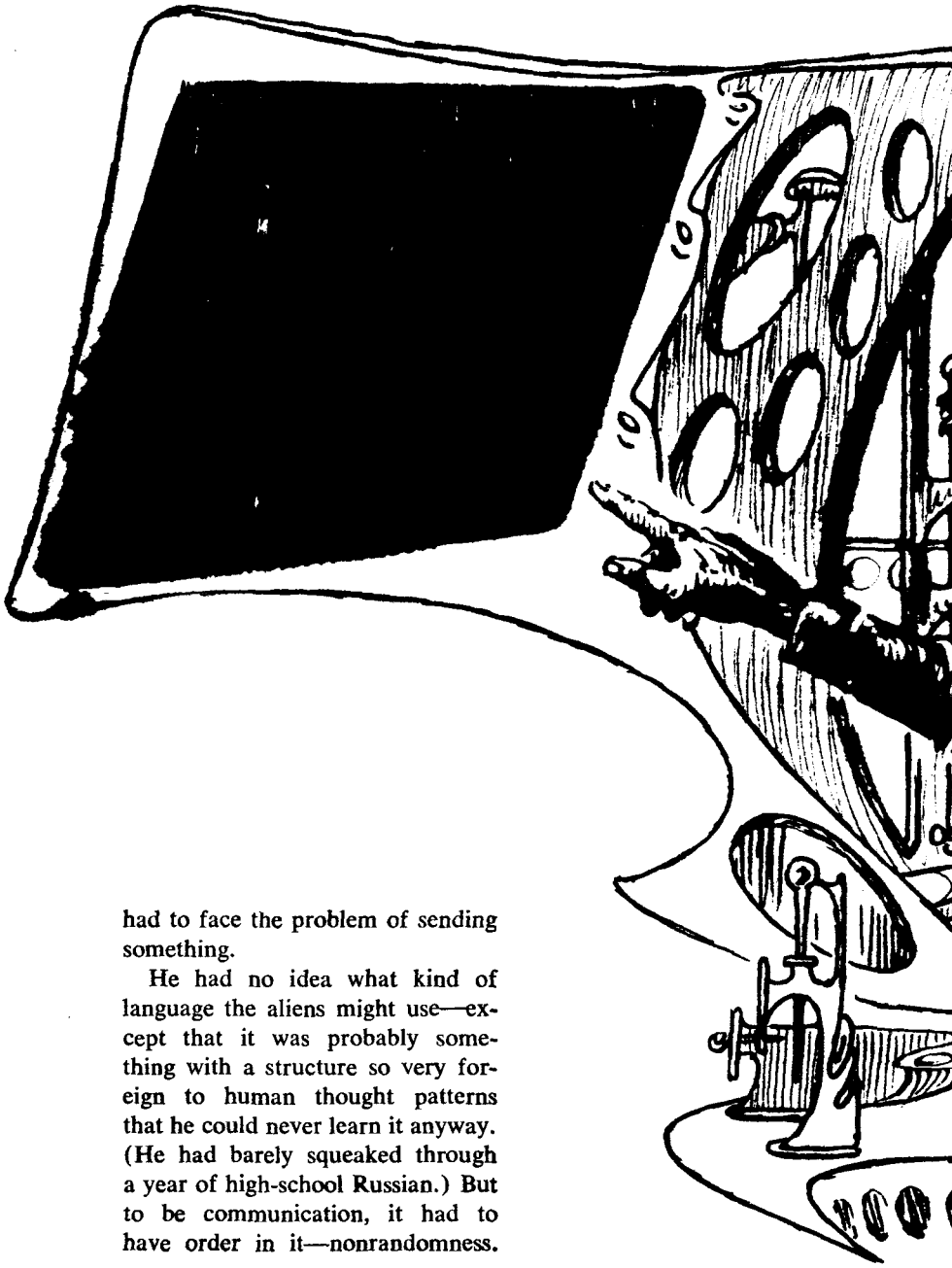

had to face the problem of sending something.

He had no idea what kind of language the aliens might use—except that it was probably something with a structure so very foreign to human thought patterns that he could never learn it anyway. (He had barely squeaked through a year of high-school Russian.) But to be communication, it had to have order in it—nonrandomness.

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He had to send something recognizably nonrandom. A simple pattern of beeps, repeated over and over and sent on a wide variety of channels. And it made no foreseeable difference what the repeated pattern was.

He plugged an audio oscillator module into the modulator input of the communication transmitter and set the transmitter to one end of its spectrum. Then he idly tapped out "Shave-and-a-haircut" a few dozen times on the TRANSMIT button, set the transmitter to a new frequency, and again repeated the process.

Meanwhile the receiver continued to scan. Five minutes later Randolph had forgotten about it and was about to fall asleep over his monotonous message when the speaker spoke.

"Hello, please," said a rather high voice with an accent Randolph had never heard. "Do you speak English?"

Randolph sprang upright. He must have dozed off and imagined he heard things.

But the voice from the speaker repeated with impeccable calm, "Hello, please. Do you speak English?"

No doubt Randolph should have been relieved to have his problem made so much easier, but he was much too startled to realize that. All he could think of to do was to slam the intercom call stud and yell, *"Captain!"*

Pelland came running almost immediately. When he arrived, the voice was saying, "We gain nothing by trying to outrun one another. We are slowing down. We will meet you on your planet and place ourselves at your mercy. Please call us to make arrangements. Begin transmitting and keep talking; we will find your signal." Then it started over: "Hello, please. Do you speak English . . ."

The captain listened with a mildly surprised expression. When it began repeating, he snapped at Randolph, "Well, don't just sit there, talk to them!" Then he walked briskly out, presumably to get the Centaurans. As he turned to go, Randolph saw him frown and heard him mumble, "I wonder what they mean, 'place ourselves at your mercy'?"

The voice kept repeating its messages over and over as Randolph yanked the oscillator module and replaced it with a mike. He proudly announced, "This is Harry Randolph, aboard the *Reunion*. I speak English."

The fellow at the other end of the line, who also spoke English, was named—approximately—Korl. In the course of making their arrangements, the humans learned that Korl was one of two English speakers aboard the *Tlasetl*. The other was Uaeu, and both had come to Alpha Centauri as guests of a mine operator named Tsongardi for

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the sole purpose of studying *Homo sapiens*. Their knowledge of English was the fruit of many long hours spent hiding in the hills with telescopes and parabolic microphones. They had been strictly limited to such remote research for reasons which they did not make clear—but which seemed to have some connection with Korl's odd reference to "mercy."

"What do you suppose they mean by that, anyway?" Vintner asked with a puzzled frown after the last awkward intership conversation had ended.

Pelland shook his head. "I've been wondering the same thing ever since we first made contact. It can hardly be that they're afraid of us. Yet it almost sounds as if they're prepared to drop everything and get off the planet if we just say the word!"

"If they'd do that," Benson said fervently, "we could all breathe a lot easier. I'd approve it without a moment's hesitation."

"Your prejudices are showing," Vintner told him. "You haven't even met them yet."

Benson glared at him. "I'm not prejudiced!" he snapped. "They may be fine people—or whatever. But they may not. And if we expose ourselves to them—in effect we expose the whole human race. I'm not about to do that lightly. If we can get them off the planet, we should—for safety's sake!" He stomped off to his own cabin.

Vintner looked after him. "I'm afraid he's going to be difficult," he told Pelland. "And it's a pity because he really *isn't* prejudiced. Basically he's a very decent sort, and rational—but he's lost his perspective in fifteen years of worrying about goblins."

Pelland grunted, but his mind wasn't really on Benson.

He was too busy trying to guess what lay behind Benson's goblins' words.

Almost immediately after landing—well over a week after takeoff—the passengers of the two ships climbed the hill between their valleys to meet face to face. A natural "conference room" among the big boulders provided welcome shelter from the late afternoon heat. The two delegations filed in through opposite ends, warily eyeing each other, and took seats on shaded rocks.

The aliens looked more humanoid from a distance than point-blank. The resemblance was mostly in shape, and at close range that similarity was obscured by differences of detail—their shortness —none were over five feet tall— differences in facial features, the hairless uniformity of their lobster-red skins. Yet Pelland felt sure he saw something like worry in their faces.

To human eyes they all looked alike—with two exceptions. One looked older than the others—and,

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if Pelland was reading their faces at all correctly, conspicuously more agitated. Korl introduced him as Tsongardi, the owner of the aliens' Centauran mines.

The other was the only one who did not look worried. He wore a large metal ornament around his neck and carried something resembling an inoperative flashlight in his hand. He remained standing while the others sat, and kept waving the thing in his hand around, sometimes seeming to point it deliberately toward individuals. Korl had barely introduced him as Ntsalu, some sort of law enforcement officer, when he took charge of the proceedings. With a brisk air of authority, he began speaking in a vaguely African-sounding language, apparently addressing the humans.

Korl translated: "I have been watching this planet with concern since I learned that two anthropologists were coming here to observe intelligent aliens. When our people first started to explore distant worlds, we had some unfortunate experiences and adopted laws to prevent future mishaps. We are free to explore, exploit, and colonize—but we are strictly forbidden to remain on any planet already having intelligent inhabitants who do not want us. Tsongardi began mining here before he knew of your colony—but you were here first. If you have disapproved of their presence, Tsongardi and his company are criminals. We will punish them and offer you our most sincere apologies for their offense. I now ask you, as prior inhabitants, to decide whether you will let them stay—or whether they should be punished as our law provides."

Pelland was too stunned to answer right away, and apparently the others were, too. This was so abrupt and unexpected as to seem almost unreal. Finally Vintner said, "Isn't that question a bit premature? I mean, this is our first direct contact with you. We don't know anything about you. We need to get acquainted before we can even think about anything like that." Benson started to say something but changed his mind.

Ntsalu shook his head. "These laws are designed to prevent *any friction at all* with alien races. Such friction is unnecessary and can be disastrous. Most stringent measures must be taken to avoid it. In this case, it is not necessary to prove that any explicit complaint was ever made. If, in my judgment, a significant sample of your people disapproved of Tsongardi's presence, his crime is complete. If, in my judgment, your disapproval was not made known to him, you have the privilege of requesting mercy. In that case his company would merely abandon the planet rather than suffering the usual punishment. I ask you only to say whether you have ever had any grievance

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against the miners—whether you have ever wished that they were not here."

"This is ridiculous!" Benson complained. "Even if we did have some minor complaint, we'd have to consider more than that before demanding anything so drastic—"

"Any complaint at all!" Ntsalu interrupted impatiently. "We cannot be too cautious!" Pelland felt the bizarre tension crackling in the air, but he thought he was beginning to see through Ntsalu. He was the aliens' own version of Gunther, a bureaucrat zealously enforcing a law which embodied a caution that even Benson found fanatical. Now he was saying, "You pursued two of our ships. Does that not indicate hostility?"

Pelland plunged into the dialogue. "Our only motive was curiosity. Partly, we were curious about you. Curious, not hostile. Do you understand the difference? And partly, we were curious about your ships. On the way here, we were surprised to see something outside while traveling faster than light. I suspected a connection between that and your ships, and I wanted to check it by following and watching one. When I saw how the first one disappeared, I figured there must be another type of ship also. The *Tlasetl* turned out to be it. Is there a technical officer here who can check my ideas?"

There was. His name was Nevfla, and he and Pelland talked at length through Korl and Uaeu, painstakingly working through translation difficulties to establish that their widely different terms really described the same ideas. The *Tlasetl* was a Kokes-type tunnel ship, a type used by the aliens mainly as transports. The first ship had been a heavy-duty freighter, using a space-warp system that had the advantage of eliminating long sub-c accelerations—but was only economical for big, profitable loads.

Not seeing the relevance of all this, the others started to look bored. Ntsalu paced impatiently among them, waving the thing in his hand at everybody in sight.

And suddenly he erupted in an excited torrent.

He had stopped in front of Tsongardi, and held the flashlight-like thing pressed against the terrified miner's forehead. Korl's skin paled as he explained: "Ntsalu has detected fear in Tsongardi's mind . . . worry about some past incident—The incident . . . the incident was the time two of us . . . Uaeu and myself . . . were chased from our hiding place by a party of hunters from your colony. Tsongardi's guilt is established!" The last words were almost a wail.

"Hold on!" Vintner broke in. "You're misinterpreting this whole thing. I was one of those hunters. We didn't chase anybody. We were as surprised as you were—and we ran the other way!"

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"That's not how Tsongardi remembers it," Ntsalu insisted, taking the probe away from the miner's head. "It was a clear expression of hostility. I have no choice but to require punishment without appeal."

All of the aliens except Ntsalu had turned several shades lighter from head to toe. Pelland was beginning to feel that he had blundered into somebody else's nightmare, and he saw deep concern on the faces of the other humans. It was Benson who said coolly, "You haven't told us what that punishment is."

As Ntsalu explained, Korl and Uaeu between them could barely get the words out. "Ntsalu, assisted by the crew of his ship, will perform the execution. You will be invited to witness the slow dismemberment of Tsongardi and each of his associates. All remains will be left for you to dispose of as you wish. Thereafter your planet will be left strictly alone by our people."

By the time he finished, Benson was on his feet and glaring straight into Ntsalu's eyes. "You do," he said very quietly and very ominously, "and I will personally do precisely the same to you."

Korl translated and Ntsalu turned as pale as the others. "Furthermore," Benson added, "if you make any attempt to make Tsongardi leave, I will improvise some refinement of your own torture for you." He looked at Vintner. "Are you with me, Darryl?"

Vintner looked at him in amazement for a moment and then nodded. Pelland's first reaction was shock—he had shared Benson's dislike of the proceedings up to now, but he wasn't sure how Ntsalu might react to that defiant threat. The first shock passed quickly as he forced his mind back to careful observation and analysis.

Ntsalu's confidence had been knocked out of him. He mumbled as if to himself, but Korl translated: "I don't understand. The law is clear—measures are provided to placate offended natives. Nothing could make it clearer than the prescribed public torture and execution that the intrusion was in no way sanctioned by us. But here it seems to have the opposite effect . . ."

"If I may say so," said Pelland, still hoping to salvage the situation, "your mistake was in insisting that there *were* any offended natives—before now." The ways of the bureaucratic mind are sometimes strange—and it wasn't too surprising that an alien bureaucrat's might be unusually so—but in reaching his present rank Pelland had had a good deal of experience with them. "I think I understand your predicament," he went on, "and I have a counterproposal." Ntsalu looked at him curiously. "You were afraid to leave your people here if there was any slightest danger of trouble flaring up—or even to take them off and leave us with any possible sus-

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picion of unpunished past offense. Now you find that we consider your proposed methods intolerable. You're disturbed because your attempt to make amends for an imagined offense has resulted in a real offense. Now you feel a need to make amends for that—but your law doesn't provide a way to do it. Correct?"

Ntsalu nodded, puzzled. Pelland said, "Well, let me suggest a very simple gesture which is guaranteed to satisfy us. Do your shippers publish route and schedule information for the space-warp ships?"

"Of course. They have to . . ."

"Well, we'd like copies of all those timetables."

Benson, Vintner, and Gunther frowned, completely baffled at what Pelland was up to. Ntsalu may have frowned too, but Pelland wasn't sure he would recognize an alien frown if he saw one. Ntsalu said doubtfully, "Well, that's certainly easy enough to arrange. They circulate freely among us. But I'm afraid I don't see why you want that, or why it should be enough—"

"I assure you," Pelland said quickly, "we don't mean to try using anything against you. We can draw up a formal agreement that will protect you against any abuse of our confidence. Strange as it may seem, we're interested in establishing a friendly relationship with you people."

Ntsalu pointed his mind probe at Pelland for several seconds and then shrugged—or at least that was what it looked like. "It's highly irregular," he said, still confused. "Not at all what the law prescribes. But since you don't react according to the book, I guess I have to improvise. To me your request frankly seems so trivial as to be ludicrous. But if it will satisfy you, I guess we can grant it." He scratched his head. "I'm beginning to wonder if I'm in the right business. I just don't understand how the alien mind works!"

Pelland had to chuckle at that. As the aliens began to realize that their lives had somehow been saved by the humans' crazy whims, they joined in his laughter.

The Little Sun was high in the sky when they finally started back down into their respective valleys. Vintner looked up at it and then at his watch. "This is the time I told you about," he told Pelland. "Midnight—or noon."

They walked on silently for some minutes, looking thoughtfully down at the spaceships and houses nestled in the Valley. The bright lights twinkling in their windows told the Centaurans they were home again, but the soft orange light which now covered the whole village was new even to them.

Finally Benson spoke. Despite his words, his voice now held a subtle note of calm that had not been there before. "I wonder," he said,

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"if I did the right thing up there? We still don't know very much about them. But I couldn't let Ntsalu go through with those barbaric threats. Tsongardi's just a small businessman who never bothered with us because he was too busy making a living—and didn't want to risk a run-in with the cops!"

"We'll see," Vintner said. "I think you did. When we were talking after we put Ntsalu in his place, they started to seem almost likable. And Korl assures us their other laws aren't so harsh."

"They're really quite a lot like us," said Pelland. "Ornery, unreasonable . . ."

"There's more to them than that," Vintner interrupted.

"Sure," Pelland grinned, "there's more to *us* than that, too."

"I wonder," Benson mused, "what 'unfortunate experiences' they had that made them so morbidly afraid of contact with other species? They must have been real dillies!"

Pelland shrugged. "Whatever they were, they sure can use the practice of trying to get along with somebody else. Come to think of it, so can we."

They had reached the floor of the Valley. Benson suddenly looked at Pelland. "Say, I wanted to ask you, but not in front of them—what was all that nonsense about timetables?"

Pelland chuckled. "Oh, that. I thought you'd never ask. Well, when that space-warp freighter we followed disappeared, we felt a jolt—because we were on the edge of the warped region. It's a little like pulling the plug on a bathtub—things are sucked into the vortex. If we'd been closer to that freighter when it warped, we might have gone right down the drain—like the *Columbus.*"

"What?" Benson and Gunther gasped simultaneously.

"You heard me. The *Columbus* got sucked into the vortex of one of their ships! This isn't just speculation—while you were chatting with Korl, I had Nevfla check old flight records. There was one in the right place at the right time. The *Columbus* may well have wound up safe on some planet very far away."

They absorbed that silently for some seconds. Then Gunther asked suspiciously, "But what's that got to do with the schedules?"

Pelland's moment of triumph had come. "Isn't it obvious? The ECC's main excuse for its restrictions on interstellar travel has been the fact that we didn't know what happened to the *Columbus.* Now we do. It's going to be hard to keep suppressing interstellar travel—provided there's some assurance it won't happen again. And having their space-warp schedules will provide that assurance."

They had reached Benson's porch and stopped in front of the

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window. Thirty hard years seemed to dissolve from the old captain's face as he realized the implications of what Pelland was saying. "Gentlemen," he said finally, "come inside and have a drink to the new era. I think maybe this one's going to really get off the ground!" ■

Statement required by the Act of October 23, 1962; Section 4369, Title 39, United States Code showing the Ownership, Management and Circulation of Analog Science Fiction—Science Fact, published monthly, for October 1, 1968.

1. Location of known office of Publication is 420 Lexington Avenue, New York, New York 10017.

2. Location of the Headquarters or General Business Offices of the Publishers is 420 Lexington Avenue, New York, New York, 10017.

3. The names and addresses of the publisher, editor, and managing editor are: Publisher, None; Editor, John W. Campbell, 420 Lexington Avenue, New York, New York, 10017; Managing Editor, None.

4. The owner is: The Condé Nast Publications Inc., 420 Lexington Avenue, New York, New York, 10017. Stockholders: The Patriot-News Co., Harrisburg, Pennsylvania.

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7.	*Average No. Copies each issue during preceding 12 months*	*Single issue nearest to filing date*
A. Total No. copies printed	156,135	158,894
B. Paid Circulation		
1. Sales through Dealers and Carriers, Street Vendors and Counter Sales	66,806	66,379
2. Mail Subscriptions	34,057	36,267
C. Total Paid Circulation	100,863	102,646
D. Free Distribution (*Including samples*) By Mail, Carrier or Other Means	1,059	1,051
E. Total Distribution (*Sum of C and D*)	101,922	103,697
F. Office use, left-over, unaccounted, spoiled after printing	54,213	55,197
G. Total (*Sum of E and F*)	156,135	158,894

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What men "know" is false, they will not study—and the physical sciences have "known" for many years that astrology is nonsense. The planets are, quite obviously, too far from Earth to have any perceptible effect on terrestrial phenomena.

That "knowledge" was, however, based on the consideration of gravity alone, in the now-almost-ancient days when magnetohydrodynamics, solar wind, and "magnetic field bombs" with power equivalent to millions of megatons, were unknown.

This was also the period when astronomers "knew" that Mercury didn't rotate with respect to the Sun, and had no atmosphere, and the idea that Venus might rotate retrograde was preposterous.

Now, however, engineers—who have to work with facts that work, *not theories that fail to—have observed as a fact that astrological weather and radio-transmission forecasts do work. Only gradually are the underlying causes appearing.*

In reading this article, there are some basic, relatively recent facts to remember:

1. The Earth is actually deep within the Sun's magnetohydrodynamic "atmosphere"; the highly ionized, powerfully magnetic solar winds blow far out beyond Earth.

2. The Sun is an immense mass of totally-ionized plasma—a practically perfect electrical conductor.

3. It has immense magnetic field forces throughout that perfectly-conducting mass.

4. The planets rotate about the center of gravity of the system— *NOT the center of gravity of the* Sun! *Wherefore the Sun must also swing around that constantly shifting center of gravity.*

5. Tidal effects in a perfectly conducting plasma saturated with magnetic fields have never been studied. Modern mathematics probably isn't even near being capable. But one can guesstimate that a thermonuclear reactor of that magnitude, being churned gravitationally, with perfectly-conductive plasma masses hundreds of times greater than Jupiter being dragged through immense magnetic fields,

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Situation of Some Gravity

JOSEPH F. GOODAVAGE

would not be conducive to peaceful coexistence!

6. And while the planetary positions may not have appreciable direct gravitational influence on events on Earth—the indirect effect of the varying gravitational angles of the planets most certainly does affect—massively!—phenomena in-on the Sun.

7. Astrology has always been a purely observational study of correlations, without much effort to explain the observed correlations—a rule-of-thumb engineering type of approach. Very early, men observed the correlation between the constellation Orion rising early in the evening with the onset of cooler weather in the northern hemisphere. A rather natural tendency to say "Orion causes *the lower temperatures," is inevitable. The old, false logical proposition "Since B always follows A, A is the cause of B." It's invalid with respect to the alphabet—however true the observation!—and with respect to anything else.*

But the observation remains true. *The ancient Britons who built Stonehenge as an astrological observatory had no valid cosmological theories—but they were damned keen observers; Stonehenge accurately predicted eclipses. That was a simple, accurate observation of a time/event correlation.* Why *they did not know;* that *they knew accurately.*

8. The observation—reported in this article—of correlation between the angular position of the Great Dipper and Earth's barometric pressure is currently in the status of "Observational datum; explanation unknown."

But since we now know that solar wind and interrelated magnetic field effects have powerful effects on Earth's weather—it's perfectly possible that the known-to-exist galactic magnetic field is involved in that observed small barometric cycle. I.e., that Earth's ionosphere is *linked into the directional vectors of the galactic magnetic field—and that the remote stars, for all their remoteness, do relate to phenomena affecting Earth.*

Personally, I find the facts cited in the following article highly in-

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teresting—though I cannot hope that they will be fully understood and correctly explained during my lifetime! ■ *The Editor.*

Part of the law of gravity states that the gravitational force of any body diminishes as to the square of the distance from that body. This may help explain the recent discovery that tiny Mercury's gravitational influence on the Sun is often greater than that of mighty Jupiter, whose mass is considerably more than all other planets combined.

It follows from this that there are myriad regions in space—interplanetary, interstellar and intergalactic—where null gravity exists. In such places, the total effect of all gravitational forces would be temporarily in perfect balance. Any physical body in such an area would be completely uninfluenced—in a sort of "limbo" insofar as field forces are concerned.

In our local system, the Earth and all other planets—not excluding the Sun—are perpetually yanked around in different directions by the combined and ever-shifting gravitational force of each member of the planetary organism.

During the astronomical renaissance started by Galileo's telescope, the popular misconception became that all known planets orbited the Sun.

The fact is they don't orbit the Sun at all. The only proper definition is that the Sun and its retinue of planets orbit their *common center of gravity*. Since our star is composed of practically all the matter in the system, the center of gravity is always closer to the star than even the closest planet. The center of gravity can also be halfway to the surface—a couple hundred thousand miles from the center of the star. It might be just beneath the surface—or *on* the surface; it could be a few hundred miles *above* the surface, or . . . as far as hundreds of thousands of miles out in space. Considering however, that Mercury, Venus, the Earth and possibly Mars lie within the Sun's atmosphere, this is not a significant displacement of the solar system's center of gravity.

A few short years from now, according to current trends, a dynamic scientific advance—every bit as important and far-reaching as Copernicus's heliocentric theory, Newton's laws of gravity and perhaps Einstein's quantum theory—of which it is a part—combined, will become as acceptable as the use of lasers.

It centers around the fact that our local star contains 99.86%—999/1,000—of the system's total mass. And yet the center of gravity of the Sun-Jupiter pair *alone* lies at an average of 462,000 miles from the solar core! This places the mean Sun-Jupiter center of gravity some 30,000 to 50,000 miles above the Sun's surface. Clearly, Jupiter exerts an enormous gravitational drag

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on a parent star 865,000 miles in diameter.

During the first couple months of 1962 the center of gravity of the solar system was drawn out to an unprecedentedly remote region of space from the solar surface—in fact, to a goodly fraction of Mercury's perihelion distance—when Mercury, Venus, Mars, Jupiter and Saturn were in almost perfect alignment on one side of the Sun. Yet these disturbances in the symmetry of the solar magnetic field are often regarded with complete bafflement by old-school astronomers. Although the solar field has a marked effect on the whole electromagnetic spectrum, it is easiest to detect by the bending of light when it passes by the Sun, a star, or any body of great mass. A clear relationship exists between mass and electromagnetic deflection.

It's an accepted fact that gravity bends light and undoubtedly other segments of the spectrum as well, yet little is actually known about the effect of the electromagnetic spectrum. Knowledge of the extremely long and short ends of the spectrum, in the words of one physicist, "simply oozes off into ignorance." In spite of this, evidence is accumulating that gravitational effects between the Sun and planets is not only dynamic, but reciprocal.

On a practical, engineering basis, magnetic storms and solar flares are at least 93% predictable. John H. Nelson, by calculating the positions of the planets, successfully predicts radio weather for the world's largest long-distance communications network—RCA, Inc. Nelson's record of accuracy hasn't wavered for almost twenty years.

"Mercury," he says, "when at perihelion, has 2.4 times as much effect on the Sun as the Earth itself. At perihelion, Mercury is even *more* powerful than Jupiter."

Nelson is mainly concerned with the quality of short-wave radio signals which are transmitted by beaming them from Earth to the ionosphere, where they bounce back to a pickup station beyond the planet's curvature. Sunspots and solar flares cause great storms in the highest part of the atmosphere. When this happens, teletype machines transmit gibberish, radio and TV signals fizzle out and the communications industry loses money—or did, until Nelson discovered the cause and a way to predict clear broadcasting weather.

Another John H., whose name is Freeman and is a scientist with the National Engineering Science Company, found that the entire atmosphere interacts through its various layers. Astro-weathermen have long recognized this and used it in their forecasts. Ionospheric and tropospheric winds perform in the same manner and are triggered by sunspots, the solar wind, and flares on the Sun caused by the gravity vector fields of the planets.

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Freeman recently announced: "The ionospheric wind patterns is impressed on the tropospheric wind pattern, and the latter is closely linked to the geomagnetic field."

Nelson *doesn't* include Gravity Vector Field calculations when he predicts solar flares and magnetic storms. For a couple of centuries the planets have been suspected as responsible for solar activity. This little-known fact is now gaining wider recognition and use—particularly by NASA.

Dr. Richard Head, the National Aeronautics and Space Administration's top electronics research expert at Huntsville, Alabama, uses the same "tools"—the planets—to predict magnetic storms—and those awesome gouts of incandescent plasma that arc across the photosphere—as does RCA's Nelson.

The major difference between their techniques is that Nelson, instead of calculating gravitational effects, says, "I need a series of harmonics, or harmonic angles—multiples of fifteen and eighteen degrees, heliocentrically, among the planets—in order to render useful forecasts."

Why isn't his record of accuracy perfect instead of 93%? "The trouble is," he said, "that sunspots don't *always* affect radio distribution. We still don't know why. Even though you can predict when sunspots will occur, you're bound to be off about 7% of the time in predicting the destruction of radio signals."

As a bright, dedicated young astronomer, Johannes Kepler initially achieved fame *not* for his astronomical work, but by predicting large, destructive—and therefore memorable—storms, *according to the rules of astrology he learned from the Danish astronomer, Tycho Brahe.* Kepler went on to refine these ancient rules and aphorisms and discovered new minor harmonics—angles among the planets—that coincided with various kinds of terrestrial weather. This was prior to Newton, therefore before the laws of gravity were formulated. Oddly, much of Kepler's astrological work anticipated knowledge of gravitation.

The gravitation of the six inner planets, Mercury, Venus, Earth, Mars, Jupiter and Saturn, cause very rapid gravity vector collapses. These quick changes result in solar magnetic storms of varying intensities. The gravity vector fields were computer-checked by Dr. Head's group at NASA; not only did they match the sunspot cycle perfectly, they also synchronized with solar flares at fifteen-year intervals.

In a precedent-setting article here—"The First Science," Analog, September 1962—we presented evidence supporting the fact that the planets are both directly and indirectly responsible for many terrestrial phenomena. It was soon followed by a "put up or shut up"

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department called "Crucial Experiment" to prove by prediction, if possible, whether nationwide weather could be determined on a long-range basis for six consecutive months.

These predictions, based on George J. McCormack's updated, "The Theory and Practice of Astronomic Weather Forecasting," were published along with the United States Weather Bureau's Long-Range Outlook—and a purely random or chance series of predictions derived by spinning a pointer in the Wheel-of-Fortune method. Interestingly, the system by which planetary forces were considered was consistently rated 94% accurate. The random forecast was 20% higher in accuracy than the Weather Bureau's Long-Range Outlook. (Lest it be overlooked, the Weather Bureau has at its disposal highly sophisticated telemetry systems, large computer installations, meteorological balloons, aircraft, rockets, weather-eye satellites, thousands of ground observers and two hundred and fifty million dollars a year especially earmarked for finding a reliable system of long-range weather prediction. It should be noted, however, that the method of the United States Weather Bureau is to observe what the weather is doing in one area of the globe, then try to guess what direction and development it will take next.)

It seems that the discovery and study of planetary influence by men of all ages in advanced cultures is inexorably intertwined with gravity. The utter simplicity of the idea is probably its chief drawback; the nature of gravitation remains incompletely understood at best. By currently accepted—and somewhat nebulous—definition: "gravity is the acceleration of a body toward a central point; *gravitation* is the power of a body to attract any other body." This tells us what it does, not what it *is*, yet almost no one quibbles about it.

The Sun attracts the planets, and vice versa. The difference is that Jupiter and Saturn, say, are capable of acting as huge but nearly ineffectual tractor beams. All the planets together, whether operating in concert or at cross purposes, exert their coupling force on the Sun. They also affect each other gravitationally, modified, apparently, by their angular distances.

Theoretically, everything in the universe affects everything else; this is particularly observable at relatively close distances, such as with the elements of the solar system as compared to distant constellations, which also have some effect on terrestrial life.

Thirty years ago, the United States Naval Observatory discovered that stars light-years distant had an effect on barometric changes in the atmosphere. Pressures as high as 1/30th of that accompanied by severe thunderstorms repeatedly corresponded with the position of

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the pointer stars in the Big Dipper.

If bodies from these distances cause such enormous power changes in our atmosphere—and these are mighty forces by man's puny standard—and since it has recently been found that Mercury, though much smaller than Jupiter, is so close to the Sun that its influence is stronger, then the Moon influences the Earth —and vice versa—in different ways than does Jupiter, Saturn, or any other planet, depending on its geocentric right ascension, declination and angular distance from the Earth. But because these forces are also acted upon and modified or shaped by scores of other constantly changing factors, the picture becomes enormously complex. Increasingly, computers are in order.

It would take the diameters of 108 Earths, placed side by side, to stretch across the diameter of the Sun. Interestingly, the Sun and Moon are each 108 times their *own* diameters from the Earth. The Sun is 400 times the diameter of the Moon and 400 times as far away from the Earth as the Moon. Nowhere else in the solar system does a planetary satellite have the same apparent diameter as the Sun. The Earth is unique in this respect and in the length of its shadow which is cast into space away from the Sun. This shadow is a mean 865,000 miles long—exactly the same as the diameter of the Sun. The Earth, plowing through the solar wind, creates a disturbance or "tunnel" more than ten times this distance. If you calculate the common center of gravity of the Earth-Sun system, the influence of the Earth by itself is so slight that this center of mass lies deep inside the Sun—close to the center of the star's incredibly hot, unbelievably dense core. Yet the Earth's influence is felt.

In the same year that the United States Naval Observatory announed its findings about barometric pressure fluctuating in phase with the position of distant stars, K. G. Meldahl published a book titled: "Tidal Forces in the Sun's Corona Due to the Planets." And Dr. Harry B. Marvis, a Naval Observatory astronomer, told the American Institute of Physics that "In accurate weather forecasting of the future, the contributions of the stars to barometric changes will have to be considered."

The results of Soviet space probes were published in four lengthy scientific reports and put into a book, "Science and Revolution," which ties in the influence of the planets to mass human behavior. The Sun, a body of intensely hot plasma, flows in whirling gravitational and magnetic vortices—tugged about by its retinue of planets. It also reciprocates in various ways—some of them still unknown. This star presents mysteries unsuspected among other suns many parsecs off in space. At its ephemeral surface, for example, the solar temperature is

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10,300° Fahrenheit. More than eight times the distance from the Earth to the Moon, the corona—at well over a million miles from the surface of the Sun—heats up to more than a million degrees Fahrenheit. Why?

At present, there's no evidence that the planets are *not* responsible for solar activity which pulses and radiates outward in electrical and magnetic activity by fluctuations in the perpetually blasting solar "wind" and sudden gravitational changes that cause great storms to tear up the highest reaches of the Earth's atmosphere. Inasmuch as the gravity vector solar flare prediction technique is correct, then weather on the Earth's surface *must* be related to the positions of the planets.

The condition of the ionosphere is impressed magnetically and electrically on the troposphere with something akin to the relationship the print on this page has to the type which impressed it.

Profound changes in the Earth's magnetic field occur during solar and lunar eclipses. "Electro-Weather," a tornado forecasting service in Kansas City, charts eclipses, planetary conjunctions and oppositions and can predict when radical changes will take place in the geoelectrical current. The most radical of these Earth current changes always precede killer tornadoes that traditionally plague the Midwest.

The United States Geological Survey at Menlo Park, in California, regularly reports anomalistic disturbances in the Earth's magnetic field—often many hours before destructive quakes occur.* This is also an operational factor at the Earth and Planetary Sciences Division of the Naval Ordnance Depot at China Lake, California; the difference being that at China Lake, researchers have traced electro-geomagnetic anomalies directly to eclipses and planetary "harmonics" identical to those used by RCA's weather engineer and scores of independent discoverers dating back to Kepler and before.

In Isaac Newton's studies covering mathematics, astronomy, gravitation and ancient prophesy, he used astrology to predict the smashing storms, aurora borealis and series of devastating earthquakes that in the year 1750 buried thousands of Londoners alive in their homes and beds. This happened twenty-three years after his own death.

Of all the planets, fast-moving Mercury is responsible for the most unusual kinds of weather. It helps to whipsaw solar plasma by exerting its influence on a regular rhythm of 88-day intervals. The Moon has been suspected of being the final triggering force for "focusing" certain kinds of radiation from the

*See NATURE: 203:508, 1964.

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Sun. Medieval astrologers referred to it as "the lens."

Depending on the value of various celestial harmonics, it is likely that the prediction of earthquakes will be made hours—or days—in advance. Disturbances in the magnetic field of the Earth always occur at the site of an imminent earthquake. Fourteen hours before the Anchorage, Alaska, quake of March 27, 1964, for example, electrical earth current readings from Kansas indicated both the disturbance and its general location. With a few hundred inexpensive earth current recorders strategically placed and monitored, the seismograph might take a back seat in earthquake research.

The most direct approach would be to correlate every quake with electromagnetic disturbances and eclipses or major conjunctions immediately preceding them. Solar and lunar eclipses, and the opposition of Sun and Moon at Full Moon periods have profound and diverse effects on human beings, too. A recent exhaustive three-year study in Philadelphia co-sponsored by the University of Pennsylvania, the American Institute of Medical Climatology, a group of hospitals, mental institutions, the fire and police departments and several large industrial corporations resulted in the conclusion that these celestial occurrences are directly related to changes in the ion count in the atmosphere, the barometric pressure, the amount of moisture, electromagnetic imbalances and ultimately important changes in the way people feel, think and behave.

This is connected to the partial or total cutoff of the solar wind during eclipses and radical changes in electrical earth current as well as to the ever-varying location of the solar system's center of mass or gravity. Human response to the intensity of electro-geomagnetic forces is coming under intense scientific scrutiny, as we'll see later on.

Medical researchers at Syracuse University, New York's Upstate Medical Center and the Syracuse Veteran Administration Hospital have spearheaded what may well be the timely nucleus of a whole new era of space medicine. Orthopedic surgeon Dr. Robert O. Becker and his colleagues mapped out the biomagnetic field generated by humans and other animals and discovered that both physical and mental diseases corresponded to and were regulated by biomagnetic changes. But what was the underlying factor?

Several years of study revealed that rapid changes in the Earth's electrical current and magnetic field were responsible for an overwhelming majority of their cases. They made the not too surprising find that these geomagnetic changes corresponded to periods of the greatest sunspot activity and to solar flares. Becker critically tested his theory by—successfully—predicting the times of the greatest

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number of admissions to six New York mental hospitals.

"Every organism, including the human organism," he said afterward, "demonstrates cycles of biological and mental-emotional activity closely linked to geomagnetic force-field patterns and more complex force-field interrelations, both planetary and solar-terrestrial in scope. Human behavior is influenced through the direct current control system of the brain by the terrestrial magnetic field, solar and planetary conditions, and both high and low energy cosmic radiation."

The tie-in is obvious. Planets, orbiting their common center of gravity with the Sun, can cause wild variations in the position of this center. It can rip into the plasmic solar body at enormous speeds—sometimes corkscrewing through the rapidly rotating solar sphere from photosphere to corona, tearing up fiery gouts to soar hundreds of thousands of miles before "splashing" down and stirring up vast storms into which many Earth-sized planets could easily disappear. These electromagnetic disturbances reach the Earth eight minutes later as tongues of charged particles, and affect the terrestrial environment and all its inhabitants.

The ancient "myth" about the Full Moon has proven to be true. Two Florida Medical men, Drs. Carl S. McLemore and Edson Andrews, surgeons and specialists in eye, ear, nose and throat complaints, decided to pool the graphs they'd made of excessive bleeders over a combined period of eight years. Result: they reported in the *Journal of the Florida Medical Association* that hemorrhaging reached a peak each month as the Moon opposed the Sun, and that bleeding dropped to a monthly low at the New Moon. Only *half* as many patients were operated on for adenoids and tonsils during Full Moon periods than at any other time!

The inconstant Moon has always been a cause of amazement, if not consternation. A commercial fisherman in Atlantic City, New Jersey, who kept very accurate records, discovered when checking them over that his catch numbered fourteen times more fish during Full Moon periods than at any other time of the lunar month.

Dr. Frank Brown, Professor of Biology at Northwestern, made extensive experiments proving that scores of varieties of marine animals responded to lunar phase—even when taken hundreds of miles from their normal environment and deprived of tidal movements, natural daylight and nightfall, or of any change in water temperature.

A wholesale fish market operator in New York's Bronx recently discovered that on a typical day he receives between six and eight crates of crabs. Yet the average take for five-day periods centering on the Full Moon is consistently better

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than one hundred crates. Furthermore, buyers who noticed the monthly increase swear that the Full Moon crabs are meatier and better tasting than those caught at any other time of the month.

Following the lead of pioneering doctors and psychologists such as Carl Jung, who was surprisingly successful in his diagnoses by examining the horoscopes of patients, bigger and better programs are being conducted by individuals and medical research groups alike. Dr. Richard Head, aforementioned researcher in this field at NASA, gets the same consistently high rate of prediction of solar flares and sunspots as any other specialist using his technique. "There's active concern at NASA centers," he admitted, "as to planetary effects and solar activity not only on astronauts, but on sensitive instrumentation as well."

An acknowledgement like this vividly recalls old science-fiction yarns about the relationships and similarities between man and his computerized-robots. The question is *not* whether we are actually influenced by the planets, but *to what extent?*

"The heavenly bodies," quoth *Hospital Focus*, a publication of the Knoll Pharmaceutical Company, in Orange, New Jersey, "have distinguishable effects on biological materials. This thesis has become testable, and has apparently been verified. Just how it may affect the practice of medicine is not yet clear, but the possibility of such an effect can no longer be ignored.

"Electromagnetic phenomena can be shown to be associated with biological processes; the terrestrial environment is rich in electromagnetic phenomena and the terrestrial electromagnetic environment is subject to variations induced by still other events in the solar system . . . gravitational changes, pulsations, changes in the intensity of planetary magnetism, and 'storms.' There is an increase of geomagnetic activity just after Full Moon and a decrease before."

Mercury's influence on the Sun, as compared to Jupiter's, is as that of Venus to Saturn. The Mariner II flyby showed that Venus has little or no magnetic field, therefore the planetary cause of solar activity is probably neither entirely magnetic nor gravitational.

Doctors are becoming intensely interested, beginning to question how the magnetic fields in living human tissue, particularly the brain, interacts with the magnetic field of the Earth. "What effects," they inquire, "devolve from the fact that the Earth is under constant bombardment by the solar stream? These charged particles distort the Earth's magnetic field, change its intensity, flatten on the side facing the Sun, and lengthen it on the dark side." Solar flares alter the magnetosphere of the Earth, pump ions into the regions of the Van Allen

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belts, and thereby incite auroras.

The Sun may seem to be a necessary, life-giving, but remote "hot spot" in space which affects us only thermally. However, this star, although containing almost all the mass of the entire system, is subjected to tremendous leverage exerted on it by its retinue of small dark "beads." A rapid collapse of the gravity vector field happens to correspond precisely with planets at angular distances of multiples of fifteen and eighteen degrees. Result: solar turbulence.

The geomagnetic field has a powerful and subtle effect on the human nervous system. Knoll Pharmaceutical inquires: "If this effect is mediated by the relative orientation of nervous system and external field, how much of man's history is a consequence of his erect posture? Other questions arise with rather prickling significance for epistemology. If it is verified that human processes are affected by the magnetic field interactions among celestial bodies, and if the Babylonians, Egyptians and Harappans knew nothing at all about wave mechanics or the solid state, *how were they able to conceive of astrology?*"

How indeed? You wonder about things of this nature, but the Central American cultures also developed astrology. The mythical Quetzalcoatl and the ancestors of Montezuma apparently had astrologers who predicted the fall of Mexico and the end of the Aztec empire by bearded white men—at least a thousand years before Cortes appeared.

Upcoming, a series of planetary quadratures (90°), oppositions (180°) and conjunctions (0°) this December, will cause solar flare activity to reach a peak of more than 180 solar magnetic storms. The last maximum sunspot period, the highest ever recorded, will be widely surpassed. The terrestrial effects of these storms should be interesting to watch.

If this cosmic pattern happens to correlate to the predictions modern astrologers have been making about world events coming up this December (Mercury and Venus will be in Capricorn, *opposition* to Earth which will be *quadrature* to Mars, *in addition to* Jupiter and Uranus in Libra—which in turn will be in *opposition* to Saturn in Aries. In the parlance of astrology, the "Cardinal Grand Cross" will culminate in unprecedented events powerful enough to stimulate the people and governments of the world to take that radical right hand into history.

We'll soon see how it works out. (One word of caution: you'll already have anticipated what the events will be a week or two before they occur, but the celestial events and their consequences were guessed at a couple of years in advance.)

The gurus have claimed since January that the eclipse of October 6, 1968, will foreshadow *events of utmost gravity* in December. ■

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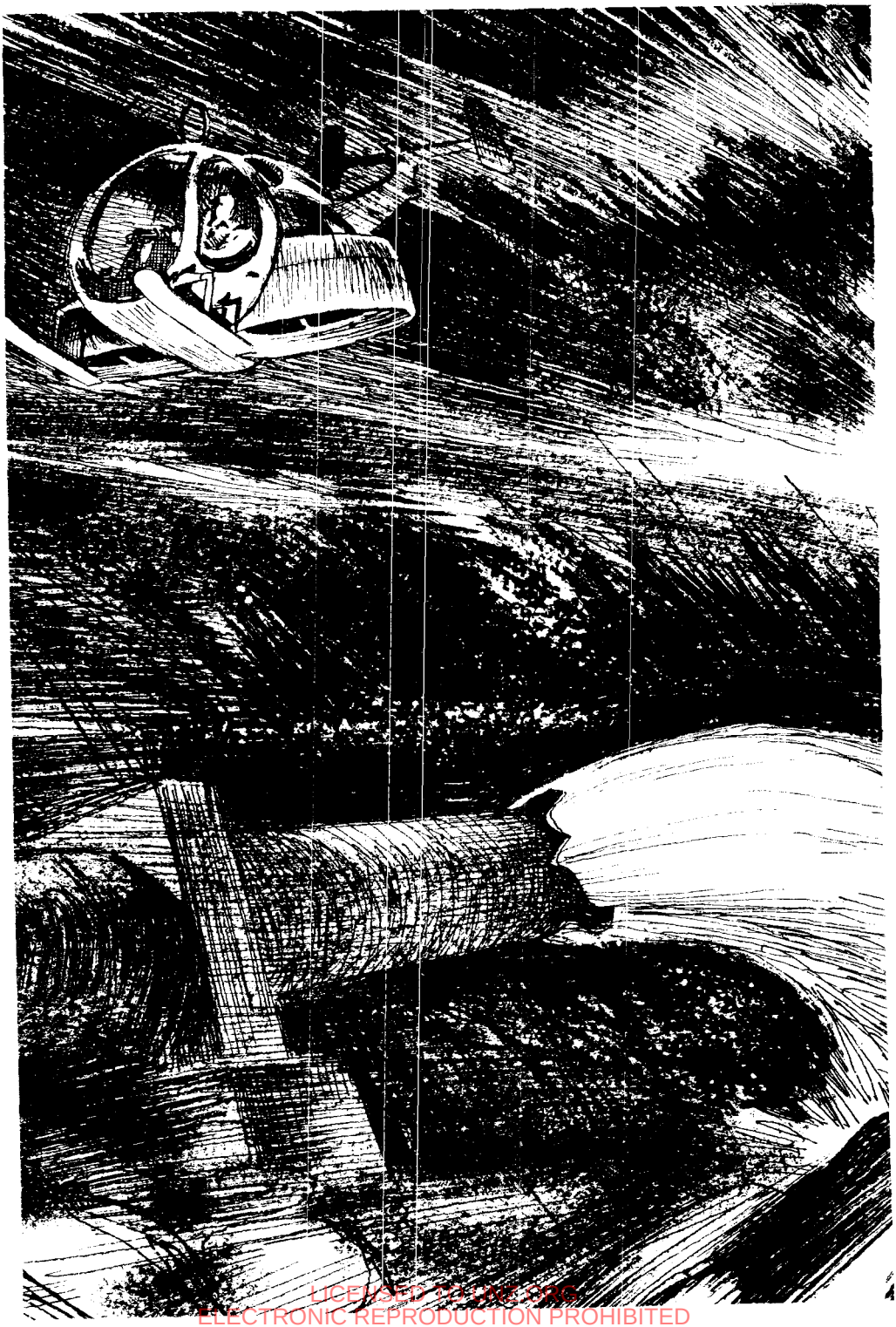

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The trouble with natural rivers tends to be they take water from where it is to place it isn't needed—and the trouble with pipelines is that there's usually somebody who sees a profit in smashing it!

JOE POYER
Illustrated by Leo Summers

pipeline

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The massive chain dredger chewed slowly to within five hundred feet of the stakes marking the beginning of the quarter mile wide shelf of granite that lay exposed to the surface. There it waited while its gas turbine power units whined down to idle, as massive and unshakable as the Ontario swamp and forest that stretched away north and west to Manitoba, Saskatchewan, and the frozen tundra of the Northwest Territories beyond. Through the last stretch of forest, beginning fitfully on the other side of the granite outcropping, the driver could see the sparkle of white caps on Lake Superior.

Robert Thompson rested an immense hand on the turbine speed control. Ahead of him, the series of locks, conduits, and piping a mile away were still hidden by the forest, but they were there, stretching south another five miles to the pipe-head. Behind him north to the vast watershed of Northwest Canada and Alaska, the pipes were ready and waiting only for him to complete this last mile of coupling to the Superior Basin Project before the water could begin to flow into the Great Lakes and from there to the drought-stricken East.

He shifted in the padded seat, aware of a curious lethargy that had settled over him in the last hours. He was rather puzzled as to why he felt no elation. Twenty years of his life, his own family lost somewhere in the past, a good many of his friends—the pipes and conduits of his own life—and even some of his own blood, spilled more than once for this crazy dream. The North American Pipeline—*the water project.*

The *life project* would be a better term, he thought restlessly. Life for a quarter of the North American continent.

He grimaced at himself, his reflection partially mirrored in the windscreen. He could see his face superimposed on the two great obstacles—and ends—of the NAP. Intermingled and interwoven with his face in a dark blur that defied separation were the blue of the lake and the dark green of the forest.

If I could have my portrait painted by a competent artist, this is how I would want it done, he thought to himself. Then surprised because he felt no shame at the egotism of the thought, he wondered why he should suddenly feel that he deserved special recognition now that the project was almost complete after having so assiduously striven to avoid it for nearly two decades. Nearly a third of his life spent in the wilderness of forest and lake and Ottawa and Washington conference tables. The burden of the project coupled with his fifty-eight years was finally beginning to wear him down.

His thoughts again returned to the image projected on the plasticine windscreen where two level

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gray eyes stared back at him from hollow caverns of eyesockets sunk above deeply tanned cheeks and a jutting jaw. The greenest-blue of the background-foreground of two of his most intimate enemies—the forest and the rock—were suddenly and symbolically dissolved in a rising cloud of debris. Seconds later, the shock wave from the eight hundred pounds of amatol flung itself at the chain digger and passed away into the depths of the Canadian north. The concussion of the explosion had done its work well and as the cloud of pulverized rock began to thin, his hand bore down on the throttle. The thin scream of the six massive J-14 gas generators coupled to the six free turbines sang through his ear guards and the monster lurched forward again toward the lake, dredging out a trough through the shattered granite bed and silently depositing the six tubes of one hundred and forty-four inch high pressure pipe from its steel abdomen. One hour away lay the first of the conduits leading deep into the lake. In two days, water would flow for the first time the length of Canada from the Great Bear Lake on the Arctic Circle into Lake Superior, suddenly turned into the world's largest reservoir. From there it would flow down through the Great Lakes—bypassing the dammed-off Lake Michigan—into Lakes Huron and Erie and into the pipe-linked arteries of the thirsty Northeast Corridor.

II

Peter Ramillies clomped out onto the wooden decking of the Project Offices for Area IV two weeks later and inhaled a deep gust of frosty morning air, then blew it out noisily. A jay squawked at a squirrel thirty yards to his right where the forest began abruptly. He caught the vermillion flash as the bird rocketed off through the firs pursued by the patronizing chicker of the squirrel. Ramillies grinned at the tiny scenario and sat down on the railing to light a cigar and enjoy the fresh morning air. Through the trees he could see the edge of the sun just beginning to top the ridge. The burnished disk quickly spun shafts of copper through the rising mist of the mild spring morning. For the first time in years, it seemed that he was really relaxed. The pipeline was finished and water was flowing clear to Superior. All that remained were the final cleanup details and then seeing to the settling of the small engineering and repair force that would continue to man the Area IV offices.

Halfway through the cigar, Chet Wilkinson, his brawny and soft-spoken straw-boss strode up the path, his face as dour as a thundercloud. Ramillies himself was six-one and two hundred and ten pounds in his stocking feet, but Wilky topped him by three inches and fifty pounds.

Wilkinson came to a stop with

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one foot resting on the first step and pushed his knitted seaman's cap back on his gray hair and glared at Ramillies. "Are ye enjoying the morning now?"

"So an' it's trooble yer a come 'ere aboot tha' a ken," Ramillies grinned mimicking Wilkinson's Scotch-Canadian accent.

"Aye, you're damn right, it is," Wilkinson replied without a smile. "The pipe has been breeched."

"What the hell . . ." Ramillies shot to his feet to face Wilkinson. "Where . . . when?" he demanded.

Wilkinson drew a tattered map out of his shirt pocket and came up the steps onto the porch to spread it out on the table.

"Here," he said, pointing with a blunt forefinger. "Section Six." The spot he indicated was a remote area east of the Horn Mountains and some forty miles south of the Lake la Martre Holding Reservoir.

"Why there of all places," Ramilles groaned.

Through Section Six of Area IV, the pipeline rode a shallow valley less than a mile long on the Lake la Martre Holding Reservoir—Slave River Depot stretch. The line had been laid into a cut made directly into the granite of the Canadian Shield after the most torturous digging operations in history, through miles of desolate and inaccessible territory, had been completed.

Beginning in the vicinity of Main North Reservoir in the high ground area between Fort Norman and Great Bear Lake in the District of Mackenzie, the pipeline ran southeast, paralleling the Mackenzie River for eight miles before turning inland two hundred and fifty miles to empty into the holding reservoir at the western end of Lake la Martre. From there, the pipeline bypassed Lake la Martre proper and ran almost due south through a series of pumping stations to Great Slave Lake. The water was then allowed to flow free into Great Slave where high-pressure pumps on the south end of the lake at Fort Resolution Pumping Depot forced 3.6 billion gallons of water per day into the double twelve-foot pipes on to Lake Athabaska at Fort Chipewyan. The pipeline, in effect, followed the giant footsteps that had created the great Canadian Lakes, Great Bear, Great Slave, Athabaska, Reindeer, the Churchill River watershed, Lake Winnipeg, Lac Seul, and Lake Nipigon before two of the cluster of twelve-foot diameter pipe segments in use emptied nearly 500,000 cubic feet of water per day into Lake Superior. Enough water to supply two-thirds of the daily water requirements of the New England and the Middle Atlantic states.

In the years following the onset of the drought that hit the east coast of the United States in the late 1950s, conditions had worsened each year. Five years after

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the onset, the amount of rainfall had dropped a cumulative total of forty-two inches below normal. Twenty years after, it had reached disastrous proportions—one hundred fifty-seven inches below normal. The entire east coast of the United States and Canada reaching north from South Carolina to Halifax and Quebec, and as far inland as Chicago and St. Louis were affected in varying degrees. Hardest hit was the Northeastern Corridor region. By the time the severity of the drought was recognized, it was too late to stem the disaster. Desalting stations were constructed in massive numbers, but they were unable to meet emergency needs let alone attain pre-drought conditions. In little more than twenty-six years the lush greenness of New England had begun to disappear into the first touches of desertlike brush. Such great eastern rivers as the Hudson, Monongahela, and Connecticut had dried to trickles as their tributaries were no longer able to supply the vast tonnage of water needed to feed their voracious maws. Even damming these vast rivers to prevent the loss of water into the Atlantic and the Ohio and Mississippi River, coupled with stringent pollution controls had not proven effective. The source of the water simply was not there.

Twenty years after the drought began, the cause was recognized. And the cause was a single two-word phrase for something exceedingly ancient and remote: *Ice Age*.

A curious geologist, suspecting the cause, had spent two years in the likeliest place that he could imagine—the Labrador highlands in an area thirty miles west of the Quebec National Seaboard and Labrador Railroad line, forty miles south of Schefferville and now directly under the new route of the North American Jetstream. With high-altitude balloons he discovered that the North American, or Mid-continental Jetstream, had shifted its mean path north carrying with it the weathermaking air spinning down from the Arctic. Its brother, the Arctic Jetstream, had also shifted north into a tighter orbit around the pole, creating a low-pressure area that the North American had moved in to fill. These twin shifts had allowed the lower mid-continental trades to also push farther north and in turn force the humid Gulf Stream winds, with their precious moisture, from their accustomed route up the Atlantic Seaboard out into the North Atlantic. This had meant that, one, the rainfall carried by the Gulf winds that ordinarily fell on the east coast was now carried out to sea. Here it met Arctic air flowing down from across Greenland. The resulting rainfall was completely wasted over the North Atlantic, hundreds of miles east and north of Cape Cod. Secondly and even more disastrous—but requiring

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hundreds of years to make its full effects felt—the moisture that remained in the mild westerlies that flowed diagonally across the United States was lost when these winds met colder air directly under the North American Jetstream over the Labrador area of Newfoundland. The last pitiful amounts of moisture left in the Westerly Trades after their long journey across the United States were now squeezed out over the interior of Newfoundland rather than the east coast of the United States.

Robert Brown, the geologist who had discovered this astounding sequence of events postulated that the first year, 1958, there was a slightly above average snowfall in the central and northern Newfoundland area. This was later borne out by official records. The summer of 1959, *some* snow was not melted due to the few degrees lowering caused by the jetstream change. By the following winter the unmelted snow had compacted into névé, the mineral form of water. After each succeeding winter there had been a heavier than average snowfall—as well as summer rainfall—so that by the summer of 1963, several feet of snow remained unmelted.

By the time Brown had reached the area he was searching for in the mid-1970s, he found a young glacier, already a half mile long and twenty feet thick. His suspicions were confirmed. A quick check of weather records for the previous twenty years indicated a relatively steep downward trend in mean winter temperatures. All the evidence was in and accounted for. The earth was cycling into a low-temperature pattern that this time would end in another Ice Age!

Subsequent computer studies revealed that nearly eight hundred years would be needed before the glacier could begin to threaten even the sparsely populated areas of Quebec and Newfoundland. But other dangers were now readily apparent. No end could be expected to the northeastern drought for centuries, although small cycles of improvement would be seen from time to time. In the long run the course was clear. The majority of the water that would normally go to the northeastern section of the United States would now fall unused into the North Atlantic.

Brown's next step was to review his old geology texts, then check out their "facts" with investigations of his own. He found that prior to the first in the series of three geologically recent ice sheets, the Laurentide Glacier of the Pleistocence Epoch that probably also began in Labrador, the southwest had been a luxurious, completely water-saturated area, while the northeast, as far south as the Kentucky-Tennessee border was semidesert wasteland. Perhaps geohistory indeed seemed to be repeating itself.

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Brown did not originate the idea of building a Trans-Continental Pipeline. But he did polish the concept and demonstrate its feasibility with a long and complex computer model that involved the entire NASA Greenbelt, Maryland, computer facilities for two months. A side attraction was the PERT Cost and Time Analysis run simultaneously that showed that the project could be built in twenty years for a total of forty-five billion dollars.

Grinning at an outraged intergovernmental investigating committee composed of members of the House of Parliament and the Senate, Brown pointed out that this was far less than the total cost of reaching the Moon, a program the United States had supported alone —and lost to a "trespasser"—and the benefits would be far more tangible in a materialistic way and that in either case, both countries stood to lose a good deal more than forty-five billion dollars if something wasn't done and fast. And that forty-five billion in any case was less than one-half percent of the combined budgets of both countries over the twenty-year construction period. He won his case.

Ramillies charged down the steps. "Let's go," he rasped and the two men sprinted down the graveled path leading to the heliport where Ramillies could see the big Sikorsky with its engines already turning over. He cursed the makeshift landing field as he hurtled the fence ripping his sleeve. They had only two heli's left since the project had moved south to completion, the other, a four-place crew transport was at Norman Wells' place for servicing. They piled into the cabin and the pilot did not even give them time to strap down properly before he pulled the fuel control wide open and they shot into the sky.

For the next hour, the 'copter bored west across the sky from the camp ten miles north of the small mining town of Rae on the northern neck of Great Slave Lake. Somewhere along the eight-mile stretch of pipe from the Lake la Martre Holding Reservoir to Great Slave the pipe had broken. Ramillies cursed silently to himself. Somehow it had happened. The pipe sections were made of a specially developed steel and magnesium alloy and "speced" far above any internal pressures the twenty-five hundred cubic feet of water per second could ever conceivably produce. Two days after completion and already they had their first disaster.

Great Slave Lake had been left behind, and ahead, hiding the valley of the Mackenzie River, the bulk of the Horn Mountains shouldered the sky. Behind the Horns and seventy miles farther west the eight thousand foot peaks of the Mackenzie range were obscured by piles of clouds building up from the

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interior of the Yukon Territory.

The Mackenzie River is somewhat of a geological oddity. It was formed along and pursues its course down the junction of two great geological features of North America, the Canadian Shield and the Rocky Mountain cordillera. The riverbed is a natural highway to the north as it lies between two broad banks. It also would have been the natural line down which to pour the billions of gallons of water that were needed desperately to the south—except that it ran the wrong way. Damming was beyond consideration.

The Mackenzie dropped some five hundred feet in a gradual thousand-mile course from the junction with the Slave River at Great Slave Lake. A dam would have flooded millions of acres of the most fertile valley soil in North America. The pipeline was built to do what nature made impossible. And now this pipeline was broken and millions of gallons of water were being wasted somewhere along its course.

III

Ramillies glanced at the airspeed indicator as the pilot climbed for altitude. Wilkinson was already peering intently through high-power glasses on the port side. Ramillies leaned forward and tapped the pilot on the helmet.

"What's the status on the search plane availability?" he shouted over the roar of the engines. "Any in the air?"

The pilot leaned back until his mouth was close to Ramillies' ear.

"Not good. Project 'copter from Wrigley turned back with engine trouble. Fort Norman Trans-Canada Air Freight has its 747-220 out, but the DC-9 and Short Sunderland are up north on a freight hop."

This news did not improve Ramillies' disposition any and struggling to contain his wrath, he picked up the glasses and began examining the terrain below. He knew who would get the bills for the 747. The pilot had managed to climb to eight thousand feet, but the wind currents made the 'copter extremely unstable and the pilot had all he could do to keep the craft at altitude in the turbulence.

They had been in the air for almost two hours when Wilkinson tapped Ramillies on the shoulder and pointed south to a shallow valley surrounded by black forests. Ramillies turned his glasses on the area and caught a reflection. He checked the map and found they were about thirty-five miles south of Pumping Station #16.

The pilot was already swinging around south and dropping lower, letting the rotors act as gyrovanes to conserve fuel. They dipped down to a hundred feet and flew up a valley that led to the area Wilkinson had spotted. The snow line was still down to two thousand feet in

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the mountains sixty miles west this late in April and Ramillies shuddered thinking of the cold night approaching. The wreath of clouds over the Mackenzie had turned intensely gray and now glowered over the river valley, portending a major storm.

The 'copter dipped up and over a broken ridge and they saw the results of the break. The pipe entered the narrow valley below them, one of the few geographical features on the otherwise featureless expanse of the Canadian tagia. As they drew nearer, through the glasses, Ramillies could see the point where the line had broken and tons of water gushing from the broken end were filling the valley to form a small lake. Judging from the height of the water on the scrub below, it was already more than five feet deep. The pilot circled above the line and settled until he was hovering at twenty feet above the exposed pipe.

"Water is still flowing!" Wilkinson shouted above the combined roars of the engines and the water.

Ramillies cursed viciously. "Set her down."

The pilot backed high up the slope until he found a flat space twenty feet or so in diameter, settled in and shut off the turbines. With the engine noise gone, the sound of the water suddenly screamed at them with the force of a Niagara. Ramillies and Wilkinson unstrapped their seat belts and climbed down stiffly. The slope led gradually to the point nearly a hundred yards away where the water erupted twenty feet high from the broken end of the pipe.

Wilkinson drew the map from his pocket and squatted down to spread it in the shelter of the 'copter. Ramillies looked around at the barren slopes on either side and west to the four peaks rising jaggedly against the deep azure of the afternoon sky. The valley in which they had landed was almost a shallow canyon, created when the Mackenzie range had pushed up in the geological upheaval that had formed the Rocky Mountain portion of the cordillera. The surface of the valley was barren of all but the hardiest lichen and bush scrub twisted into tortuous shapes by the keening wind. Immense boulders, tumbled down from the ice sheets millions of years ago, dotted the lunar-seeming landscape and heavy, coarse gravel covered the exposed slopes.

The pipeline itself was cut into the valley from the western rim and had been tunneled through the granite by small, shaped nuclear charges developed for the Project. Men had followed with handtools, power drills and borers to cut a level trench below the surface of the Canadian Shield. The depth of the trench ran anywhere from twelve to eighty feet to create the level-supporting bed and the three-degree niches that kept the tons of water flowing for thirty-five miles

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before it smashed into the turbine wheels at Power Station #15 south. The speed and pressure of the water created eighty percent of the power that it needed to pump itself over the last thirty-foot barrier that lay between #15 and the Slave Reservoir. The speed and the interior baffling of the pipes kept the water at an average 40° F., although surface temperatures might drop to sixty below. And now, 1.8 billion gallons of water per day were blasting out of this one broken segment at eighteen miles an hour.

The two men moved as close as they dared and Ramillies studied what remained of the pipe section. As he watched, another piece of three-inch thick steel alloy was torn loose and blasted into the new lake. The sound of the water was so intense that it tore and screamed at their eardrums. When they could no longer stand it, the two men scrambled back up the slope to the 'copter and crawled into the cabin where the noise was cut somewhat by the soundproofing.

"Mr. Ramillies," the pilot said, pointing to the radio, "I got hold of Fort Norman by satellite relay. We're too far down in the rock for anything else. I gave them our position and told them to get a crew in. They report weather breaking over Great Bear and they're not sure their plane will get back in time to fly out before the snow. They called Wrigley and Fort Providence earlier but they have the same trouble. Norman Wells does think they can get a crew out about an hour from now but the weather picture isn't too hot there either."

Ramillies said a nasty word.

"Yeah, I agree," grinned the pilot. "And that ain't all. Thompson got back to Superior from New York about five hours ago and started the test sequence on the net into the Corridor. Water is flowing clear to Albany."

"He's a day ahead," Ramillies groaned.

"I told them water is still flowing, but they say their board shows red for shutdown. So far it's O.K. They closed Main Terminal to a quarter flow. They say Lake la Martre can carry it south of there for another two days. After that the distributing reservoir is empty and all hell breaks loose."

"Two days," Wilkinson muttered. "We've got two days to fix this monster, out back of nowhere with weather setting in. What do they think we are, miracle men?"

Ramillies said nothing. He had visions of at least forty miles of pipe exploding as the end of the water rushed south from Lake la Martre when the holding reservoir went dry. The water flow needed to be maintained to at least an eighth flow to avoid breaks in the stream. Water at ninety tons of pressure was almost solid and if the flow was closed off without proper bleeding precautions, the stream as it retreated would create tons of turbu-

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lent air pressure that would blow out the pipe behind the water. Pumping Station #16 could easily handle the bleeding in the thirty-five miles of pipe to the break. So there was no problem. The station computer net had probably not yet received instructions to shut down.

Ramillies peered at the mountains to the west. The black snow clouds had settled into the valley behind the Horn range. It was beginning to look like they would have a day or two before it could build up enough steam to roll over the three-thousand-foot peaks. If he could get a crew in by nightfall, they should be able to patch the pipe before they got snowed in. It would be close, and he wondered whether or not it would be worth the gamble.

The three men sat glumly in silence for a few moments, then Ramillies, reaching a decision, ordered all emergency gear out of the 'copter and the pilot back to Rae to get help to them. He and Wilkinson would stay to assess the damage and call the crews down when they arrived

"But, if they can get a plane out before the weather closes down, make sure they get it out, even if the pilot has to go on to Spokane or Victoria before he can land. Call Thompson at Superior and make sure #16 gets shut down. We can't do a thing until he does."

Ten minutes later, Wilkinson and Ramillies backed away from the 'copter and the pilot took her straight up, pulled a tight half orbit and disappeared over the southeastern end of the valley. Ramillies and Wilkinson set to work hurriedly to get the gear up higher on the slope until they had the lee side of the steep wall at their backs. Wilkinson blew up the tent, while Ramillies got the Coleman burner going and squared equipment away. Inside the tent, both shrugged into tight-fitting, wide-mesh arctic underwear and pulled nylon foul-weather gear over. The sun had dropped behind the high western rim and the temperature was down to 28° F. There were still about three hours of daylight left, then they had the fuel cell and floods. Ramillies intended to make full use of the time until the repair crew arrived. They had at best a day and a half before snow.

IV

Robert Thompson sat quietly with his back to the deep, curved desk in the Project Director's suite, Superior District office at Fort Williams, Ontario. The room lights were dimmed. Pinpoint spots set in the ceiling illuminated the desk and the crystal snifter of brandy in his hand glowed a deep bronze, stipled with colored reflections from the wall dispay.

From his vantage point fifty feet above the narrow beach, Thompson could see through the fading

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twilight, the breakers smashing into the concrete and steel abutment that was the terminus of the North American Pipeline. Far out on the lake, almost lost in the darkness, the lights of a lone freighter out of Port Arthur, low and narrow, cut the eight-foot waves as it headed for Sault Sainte Marie three hundred and twenty miles away, anxious to be first on the lake for the new season.

Thompson suppressed a long, shuddering sigh and swiveled away from the window to the papers before him on the desk. He studied the cryptic flimsies transmitted by teletype from Fort Norman and raised his eyes to the glowing map of North America before him on the vast wall.

The map itself, softly lighted to bring out the almost fluorescent colors of the greens, blues, and browns of the continent was topped by the glowing yellow bar that indicated a Class III alert.

He swore mildly and felt a little better, drained the glass and set it down beside the newly opened bottle.

"A Class III alert before we even begin to operate properly," he muttered half to himself.

On the map, the section of pipe from Lake la Martre to Great Slave glowed angrily and brighter dots of red shone where the break had occurred. At least Ramillies was on the job there, he considered, that was something. But even so, he wouldn't give a snowball's chance in hell that the break could be repaired before the blizzard came down on them.

He brushed aside the pile of telegrams and teletypes expressing congratulations on the successful completion of the construction and test phases of the North Section and found the control panel. Thompson skillfully projected the weather overlay onto the map and watched the minute shifts reflecting weather pattern changes.

He swore at the weather, swore at the project, swore at everyone connected, and swore at the weather again. Most of all the weather. The jetstream mean path changes had so royally fouled weather patterns that the entire book was being rewritten.

The west wall showed the patterns of cloud, wind current, and temperature on-line as seen from the ATS polar satellite. A disturbance off the coast of northern Alaska and well out into the Beaufort Sea was sending masses of cold air into the interior and along the Arctic coast. It had moved inland, up and across the Rocky Mountain barrier and was now spilling down over the eastern flanks of the Mackenzie. The North American map showed the cold air as a blue screen beginning to flow down the valley, picking up speed as it went. Already the first tendrils had reached Norman Wells, fifty miles above Fort Norman; and they were already re-

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porting winds of thirty knots and rising.

Centered over that area was a low pressure front of warm air. When the two fronts met, a rainstorm would explode; the rain would lower the atmospheric pressure and turn into snow and the following cold front would blast down the valley all the way to Great Slave Lake before it would even begin to slow. Tomorrow night late, the Superior area would get the storm as high winds and rain that would blow out over the lake and die as it hit Michigan's upper Peninsula. But, the main part of the storm would hang over the Mackenzie Valley for the next five days before it all slid down into southern Canada.

The storm itself did not worry Thompson so much. If Fort Norman closed down, they could still get aircraft in with pipe and crews from other areas. They would waste a few hours doing so, but at least they would get them. What worried him was the storm over the valley would cause a low-pressure center over the Rockies which would draw in warmer offshore weather. The result might very well be heavier snow than the weather bureau was yet predicting and practically blizzard conditions at that. It had happened before. Late spring blizzards were no rarity in the Mackenzie Valley. Two days, he gave it as it stood now. Two days, with the weather worsening every moment. But if warm offshore air did flow in over the Rockies, if that did happen, then they would have less than eight hours.

His attention was distracted by the message light. A Xerox slid through and he read it with a sinking feeling.

Fort Norman: Weather worsening. DC-6 and Sunderland grounded. 747 returned but unable to take off. Winds at 40 knots with medium snow conditions. Temperature 25° F. and falling. Barometer 28.5° and falling. Last communication from Supervisor Ramillies relayed by Rae indicates break site located and now undergoing evaluation. Request why cut-offs at Power Station #16 have not shut down flow. Indicates impossible to repair under existing conditions.

"What the hell," Thompson roared as he read the last two sentences. The board showed #16 glaring red, indicating a total shutdown.

He slumped back in his chair, staring at the baleful red eye of #16. There were triple circuits in each station, all entirely independent and all made as fail-safe as humanly possible. The warning map grid circuits were computer controlled and reliability factors were 99.99997% effective. Number 16 *was* shut down.

Yet Ramillies' report indicated that water was still flowing. The

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break had occurred—he glanced at the elapsed time—four hours and thirty-seven minutes ago. Ramillies had reached the break two hours and twenty-three minutes ago. Only fifteen minutes were required to clear each section of the pipe to eighth flow. Something was wrong, terribly wrong. Thompson resisted the urge to pick up the phone, forcing himself to lean back and think calmly.

First of all there could be no short circuit or other natural cause that would allow that warning light to indicate a system shutdown when it, in fact, had not. The computer links were expected to have such emergencies and hunt immediately until they found an undamaged circuit. So, control equipment failure was out. On the off chance, even though almost nil, he snapped on the intercom and ordered "bug hunting" programs run in all project computers by available sections. Then he turned back to the window to think.

Ramillies was on the spot and he had reported unequivocally that water was still flowing two hours and twenty-three minutes after it should have halted. A blind man could not make that mistake. And he was anything but blind. Thompson thought so highly of him that he was secretly being groomed for his post as Project Director. It was no mistake on Ramillies' part! That left a second possibility. Perhaps that million-to-one-shot had occurred and somewhere in the system there was a short circuit and the proper switching had not occurred. If so, the "bug hunting" would find out.

Thompson sat up and grabbed the phone.

"Jim, this is Bob. Get me a status check on #16. Ramillies says water is still pumping."

He cut short the other's amazed protests and told him he would wait. He turned back to the lake, now completely shrouded in darkness except for the faint phosphorescence of whitecaps streaming onto the rocks. The lights from the freighter had disappeared over the horizon. Silently he wished them *bon voyage*. The storm blowing in would catch them in the middle of the lake. Spring storms on Lake Superior, he knew from experience, could pack the punch of winter storms in the North Atlantic and with waves almost as high. She was a dangerous lake and the man who sailed her respected her moods.

Thompson's rambling thoughts were interrupted by the Programming Room. With an effort he wrenched his thoughts back to the task at hand. It was as he suspected. The readouts for Power Station #16 indicated all systems shut down and no flow. Thompson thanked them for their efforts. Immediately, his deputy was on the comm. line to report that they could make no contact with the computer at #16.

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Without hesitation, he gave the order he never thought would be needed.

"The tie line," he commanded, his voice surprisingly firm. He only wished he felt as confident as his voice suggested.

Thompson only had to wait a few seconds before almost simultaneous clicks indicated that both the Prime Minister of Canada and the President of the United States were waiting.

"Gentlemen," he said brusquely, without further greeting, "we have a sabotage situation!"

V

The wind, whipping down the valley caused an eerie ululating in the roar of the water jet as it plucked at the two men working on ropes as close to the broken pipe as they dared.

Ramillies inched himself lower and lower until his boots dangled bare inches from the solid stream of water. Even with sound baffles over his ears, the roar was almost unbearable. He brushed his goggles free of spray and peered down at the steel pipe that was slowly being torn to pieces with the pressure. Wilkinson had rigged a floodlight that caused the stream of water to appear as a bar of shimmering silver held in the maw of a black snake. Satisfied, he began climbing up, hand over hand until his feet touched the shallow slope of the higher bank. Five minutes later Wilkinson joined him from further downstream and they trudged back to the tent and crawled in.

While Ramillies stripped off his outer parka and nylon pants, Wilkinson set a pot of water on the double mantle stove to boil, then got out the tea and sat back on his heels to wait.

"It looks very bad," he said, watching as Ramillies fiddled with the walkie-talkie. "What I want to know is why the water is still pumping. It should have shut down more than four hours ago."

Ramillies grunted and pulled the antenna out as far as it would go. Wilkinson continued to crouch near the stove watching him, his normally placid face creased into worry wrinkles.

"KX-1 to Base," he repeated several times, waiting in between each call for an answer.

"Damn," he swore, "we're too deep and the rock is screening the transmission." He tried once more and was about to give up when the transceiver clicked and a new voice came on.

"KX-1, read you loud and clear. This is RCAF-490 out of Fort Chipewyan. I have the construction crew and equipment you requested. Acknowledge."

Wilkinson whooped and rolled out of the flaps with Ramillies right behind. They both stared up into the threatening sky where intensely black clouds roiled and churned.

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"RCAF-490, this is KX-1," he yelled into the transceiver, "read you loud and clear."

"KX-1, I have twelve men from the Army construction unit at Lake Athabaska. Where shall I put them down? Do you have ground flares, or should I drop mine?"

"RCAF-490. I understand. Ground wind speed estimated at thirty knots. Winds at higher altitude stronger and extremely turbulent. It would be suicide to drop those men."

"KX-1. All are trained jumpers and have power parachutes. They say they will chance it. What about flares."

"RCAF-490. It's your show. Use your flares, please."

As he finished the sky broke with flame and he could clearly see the big Canadian military jet orbiting tightly over the canyon at one thousand feet. As the flares drifted down, two more erupted, the aluminum light etching every shadow into a stark blaze of nothingness. The faces of the two men as they peered upward were drawn tightly into planes of black and white: staring skulls with hope glaring from the sockets.

Seconds later, a line of figures tumbled from the aircraft's side and whipped back into the slipstream, spinning like so many rag dolls. The jet vanished beyond the wall as the figures straightened one by one beneath the impossibly small patches of colored plastic.

Moments later, the aircraft was back, releasing two more flares above the plummeting men. The parachutists were falling faster with each second now until they were barely a hundred feet from the valley floor. Then, the chutes burst wide, their breakneck descent slowed abruptly and jumpers touched gently down one by one, a hundred yards up the slope.

Wilkinson trotted to meet them as Ramillies thumbed the transmit button again.

"RCAF-490, all personnel chutes down safely," he reported.

"Right KX-1, cargo coming on next pass."

He could hear the roar of the four jet engines above the wind's threnody as the plane dipped down toward the valley. It gained in intensity as the plane fought west against the turbulent air now less than six hundred feet above. Two rocket flares winked from beneath the wing and burst almost over Ramillies. Then the plane was above him, cargo trailing out through the clamshell doors and blossoming as air caught the white canopies. As the plane passed, Ramillies tasted the first sharp tang of snow on his lips and seconds later, the pinpoint light of the flares grew muffled as snow filled the sky in wind-whipped streamers.

"KX-1, this RCAF-490, we can't see a thing here, climbing to altitude. I've done all I can for you

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and we're running with heavy icing."

Ramillies paused before answering. He could no longer hear the aircraft, and even the voices of the approaching construction crewmen were strangely distant in the white blanket. As the snow thickened, the wind died away to a vagrant breeze and the thick silence it brought was unearthly.

"RCAF-490, thanks for the damnedest job of flying I have ever seen. Good luck."

"Good luck to you. *Hasta la vista.*" This last was almost lost in the growing static.

Ramillies was about to shutoff the transceiver, when another voice broke in.

"KX-1, this is Geepv-2, do you read me? KX-1, this is Geepv-2, for crying out loud, where the devil are . . ."

"Geepv-2, this is KX-1, what . . ."

"Sorry, Pete, but . . . the snow is too thick to see. I caught a glimpse of a flare and part of your transmission to 490. Then the snow closed in. I'm above you . . . I hope . . . and holding a tight orbit. Get me something I can see!"

Ramillies didn't wait to hear the rest but was racing down the slope to the searchlight. He tripped over a cable and fell headlong to stop only inches from the steep slope to the broken pipeline. He did not even notice, but sprang up and had both powerful lights pointing skyward and was fumbling back along the line to the control switch. He found it and flicked it on.

The two intense beams blazed skyward, diffusing and losing themselves in the snowfall. Ramillies was panting back up the slope to the tent and the flares, but Wilkinson was ahead of him outguessing his need. By the time he had reached the tent, Wilkinson had fired an aluminum flare, all but blinding the fourteen men retreating towards the tent.

Ramillies tore the transceiver off his shoulder. "Geepv-2, do you read me? Geepv-2 do you . . ."

"KX-1, I read you, but where is the light. I can't see a blasted thing."

Ramillies strained his ears, trying desperately to pick up the sound of the Geepv's single engine, but the roar of the erupting water drowned everything.

Wilkinson ran to the far end of the level site and triggered a second, then a third flare.

"This blasted wind . . ." the rest was lost in a roar of profanity and static and Ramillies cursed the weather, the pipeline and everything else he could think of.

Suddenly, "Tallyho, the ground, I think I've . . . yes, I do see you. Watch out below." The strain was gone from the pilot's voice and Ramillies heard the roar of the engine and the wind over the transceiver as the pilot shot down toward the light. Then he heard the

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high whine of the engine and a minute later, made out the dim outline of the Geepv settling slowly, almost on top of the center flare.

The construction crew broke into a ragged cheer as the full impact of the drama burst upon them.

Ramillies was with them running for the Geepv as the pilot climbed stiffly down, already being pounded on the back by Wilkinson.

"Pete," he yelped, "it's MacIntyre himself."

"Mac!" Ramillies practically flew the last several feet and grabbed the pilot by the shoulders. "What the devil . . . How did you get here?" The two men pounded each other as they stumbled toward the tent. Ramillies was half inside before he remembered.

"The cargo. Everybody fall to and get it in," he shouted. Through the snow he could see one of the strobe marker lights flashing red and ran for it.

"Two of you," he roared, "get this back to the tent."

Two hours passed swiftly. Two exhausting hours during which Ramillies drove the men to search the area for the missing pallets. He ordered all of the search lights turned on and swung to cover a quadrant at a time while the crew fanned out to search to the end of the beams. The powdery snow was already being whirled into thick drifts. As the winds began again, slowly at first, then increasing quickly as if keeping pace with the rising fury of the blizzard, stinging ice particles clawed at the exposed skin of faces and hands, driving anesthetizing needles into the flesh. Ramillies lost track of the number of times he stopped to knead feeling back into his face. Finally, he was forced to call off the search and the weary men crawled into the one large tent to inventory the gear they had managed to salvage.

There was enough food for five days—if rationed carefully—but no extra tents and only five gallons of heater fuel. Ironically, the single large pallet that had landed safely up the bank from the water had carried all of the pipe supply, several times more than they would need; the small derrick and winch but no other heavy equipment and heaters to work the plastic pipe. Fortunately, they had found the crate holding the welding epoxy up near the crest of the valley. Without the epoxy, there would have been no way to join the piping.

While Ramillies, MacIntyre and the Army crew made the inventory. Wilkinson and Orlowski, a large florid-faced Pole and the Sergeant Major of the Canadian Army construction unit, went over a large-scale relief map and developed plans to blast a channel through the sixty feet of high bedrock that rimmed the southwestern end of the valley, separating it from the sloping plain of muskeg. Orlowski estimated that enough explosive had

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been recovered to do the job—supplemented by a lot of shovel work since only the one light-weight rock drill and power pack had been found.

The wind outside had risen again to a steady shriek, driving the frozen ice particles before it with the seeming destructive power of a sand blaster. Ramillies surveyed the clean-shaven faces of the construction crew that already looked gaunt and half starved in the white, steady light of the single lantern. He shivered uncontrollably, of a sudden aware that he had left his outer garments in the small tent when the aircraft had made its first pass.

He found Orlowski studying him with the discerning eye of a construction boss who can instantly tell a good engineer from a poor one. It was plain that he already approved of Wilkinson as he squatted next to him. The rest of his crew, hard-faced, but career Army men, had wasted no time. In the close confines of the tent, they had lain out the sleeping bags and managed to make up extra blanket rolls from the few blankets and from the parachutes and pallet wrapper mats. Now they all watched him expectantly.

His first elation at seeing the cargo chutes trailing the pallets had vanished with the knowledge that the most important pieces of equipment were lost beneath the rolling waters, now less than thirty feet below them. But still they waited, waited for his instructions to get the job done. Stalling for time, he glanced at MacIntyre.

"Gentlemen, this is Ralph MacIntyre, my section chief at Great Bear."

MacIntyre acknowledged the introduction and produced the explanation for his presence without being asked.

"I heard," he drawled, "that you had some trouble up here, so I grabbed the Geepy and headed over. I'd have made it sooner, but I lost a couple of stators and had to put in to Fort Norman and wait for the other Geepy to get back so I could load up with fuel and come on out.

"Oh yeah, before I forget again," MacIntyre continued, "I dropped a relay beacon up on the high ground above the valley. You should be able to make contact with Fort Norman and they can relay from there."

Ramillies nodded. "Good thinking. Before this shindig is over, I have a feeling we are going to need it." He scratched his chin, then ran a hand over his close-cut hair, the unconscious actions reflecting the frustration he felt.

Ramillies glanced around at the range of expectant faces circling him. "For some reason," he began, "Pumping Station #16 has not shut down and I'm damned if I know why. I think we have enough gear to patch the break but we can't

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even start to work on it until we get the water shutdown and that blasted lake that it's building drained out. Since Mac dropped the relay transmitter, maybe we can stir up some action to get it shut down. If not, we are stuck here until this storm blows over. And, I might add, that I figure we have maybe two and a half to three days to get that break patched. With the water pouring down the pipe like it has been, it won't take much more to empty the Lake la Martre Holding Reservoir. And you all know that we'll lose forty miles of pipe if that happens."

The glum expressions on the faces of the construction crewmen told him that they understood only too well. Ramillies pulled the transceiver over and flicked the transmit switch grimly. "Let's see what happens now."

Fifteen minutes later, he thanked the Fort Norman District Supervisor and signed off. Ramillies sat back and stretched his legs.

"You heard him," he said quietly. "They have no contact with #16 and their board shows green for proper cut-off. According to them, water is not flowing past #16."

"Damn fool, then. You only have to listen closely to the bonny noise out there," Wilkinson muttered. "What next?"

"Get up to #16 and find out what's wrong," Ramillies replied in the same quiet voice.

"Thirty miles across this country in a howling blizzard. Just how do you propose to accomplish that," Orlowski rumbled.

"That my friend, will require some thinking," Ramillies replied.

VI

Thompson sat facing the shimmering square of the TV screen. The carefully controlled faces of the two men, the Prime Minister of Canada and the President of the United States stared at him from the split-image screen. Neither spoke for a long moment. Finally the President said:

"Are you certain?"

His answer was a simple yes.

"What do you recommend?" the Prime Minister asked slowly. "A Red Alert."

Thompson sat quietly for a moment, then leaned forward to tap his fingers on the desk.

"No. I don't think the emergency warrants that yet. We still do not have enough actual data to go on other than a pipeline break and a warning and shutdown malfunction that is patently impossible. However, I would recommend we go to Class II and full security."

"I see," the Prime Minister nodded slowly.

"What do you need then, Robert," asked the President, using his first name for the first time in ten years of bitter political feuding over the project.

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Thompson smiled thankfully at the screen and his former friend.

"At the moment, only your support in any way I may need it, up to and including calling a Red Alert. I want NORAD headquarters put on a Red Condition, but keep everything else normal. I want to know and so do you, immediately, if this is going to be followed up. Although," he said half to himself, "I don't know why it would be before the system becomes fully operational . . .

"That's it then, gentlemen," he finished briskly, "do I have it?"

"Of course," they both said together

"What about men and equipment," the Prime Minister asked.

"Thanks, but the whole area is blocked solid by a blizzard. I already have my best foreman and one of your Army engineering crews in there. They'll have to manage by themselves."

They exchanged goodnights and Thompson leaned back in his chair. When the red map border light was supplemented by an additional broad red warning a few minutes later, signifying that Continental Defense Headquarters was on an all-out alert, he snapped on the intercom and called for coffee, then tore off the latest Xerox status report and swiveled his chair to the windows again.

He needed time to think—desperately needed time. He brushed a hand across his face and settled back in the chair with the coffee cup, forcing himself to relax. Gradually, as he drank and watched the eddy of waves against the beach, the hard knot of tension in his middle untied itself.

Sabotage, he thought, almost reluctant to put a name to it. Sabotage, there could be little doubt about it. The evidence was circumstantial as yet, but a red signal from #16 indicating full shutdown when water was still flowing at full force and no control over #16 from the NAP command offices could only signify one thing: Someone had caused the pipe break, jammed the controls at #16 and left him and the entire project to stew over it. The question now was not so much how, but who. The how was easily taken care of. An explosive charge against a section of pipe and the damage was done. NAP must depend on the inaccessibility of the pipe, more than anything else to guard against such acts. It was patently impossible to guard all twenty-seven hundred miles of pipe —especially the eight hundred miles of it which were exposed above ground.

He wondered, staring out over the lake, now turned into the single largest reservoir in the world, whether they had actually meant to destroy the entire key section between Lake la Martre or merely to delay the final completion phase. But who? That, he thought, was the prime question. With weather

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bearing down on the break area, solving the *who* would not repair the break—but it might tell him whether or not to ask for a Class I RED Alert and all its attendant dangers. He shuddered to think of all of those keys turning and fingers poised over firing buttons on both sides, waiting for the single voice command to go. In the soft reflection from the window, he could see himself partly mirrored again, only this time there were no trees and lakes as there had been in the cab of the chain dredger three days before, only the red light bar above the map hanging over his head like a burning sword.

Angrily, he shrugged to dispel the intruding thought. Who? The Soviets? No. They had more to lose than to gain if the pipeline were destroyed. Not only were there vast areas of Asia that could be watered by these same techniques, but they could not afford to see the United States ruined economically if the vital Northeastern Corridor was threatened. Ironically, the United States was now their only dependable ally against Red China.

Red China? He doubted it very much. Could they afford to take such a chance with both the Soviets and the United States waiting for any overt acts of sabotage to move against Chinese gains in Southeast Asia and India? He did not think they would risk such a desperate gamble nor so minor an attack on the pipeline. If they did, it would be in a big way, an all-out move.

That left him with two groups and the strangest of alliances in this impossible world of impossible bickerings: The Southeast Asian Sphere of Greater Co-Prosperity and the Save-Canadian Water-Committee. Forty years had passed since the end of World War II, forty years in which to heal the major scars of millions killed and maimed and national hopes burst asunder. Forty years to do economically what the Japanese nation could not do militarily, make all of southeast Asia one common market in the realest sense of the term.

The pipeline, combined with the cargo-carrying jumbo jet was going to prove a very real economic threat to Japanese investments in Alaska and Western Canada. Already there was a tremendous opposition building in both Parliament and Congress against foreign exploitation of United States and Canadian natural resources. The Canadian save-the-water bunch had grown increasingly stronger and more vociferous over United States exploitation of Canadian water as the project neared completion. Granted they were a right-wing group on a par with the Birch Society or American or German neo-Nazi Parties, but they had plenty of money. And they conveniently ignored the fact that the pipeline was already being extended into Alaska and that it was bringing directly

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and indirectly billions of Canadian and American dollars into Western Canada and the Northest Territories. For the first time in history, the Mackenzie River Valley, the richest potential farmland in the world was now accessible due to the pipeline and the massive construction it had brought.

Ever since he had received an intelligence report a year ago, describing the alliance that had been set up between the water savers and certain Japanese and one Indonesian business firm, he had been waiting subconsciously for the ax to fall. Was this it, he wondered, staring into the deepening night?

If it was, then God help them, Thompson thought, when they opened the other four pipes over the next five years to feed a total of 9.6 billion gallons of water a day down from Alaska, Yukon and the Northwest Territories into Lake Superior and from there out into the web of pipe, rivers, reservoirs, and aqueducts that would carry it to the entire southwest and the northern Mexican States. Already, the linkups between the old Feather River Project in California, the Colorado Channel in Arizona and the Proiecte Aqua Conchos in Mexico were being pushed north to the Wyoming Depot. Trenching had already begun for the pipe that would be laid north.

Thoughtfully he swiveled around and pulled out his typewriter. He paused for a moment, then rolled a sheet of paper into the carriage and began typing a memo to the Canadian Prime Minister. He was willing to bet that when the news of the pipeline break got out, there would be a call for a vote of confidence in Parliament. The Prime Minister should easily be able to handle this one . . . but there would be another. . . He typed quickly, certain now that he could see the thread unwinding from this relatively insignificant act. Thank God, Ramillies was there to keep it insignificant, he thought fervently.

The night was black and still, broken only by an occasional colored light topping the security fences. The sky was completely overcast now, lending an oppressive quality to the scene. Thompson saw again the ghostly reflection of himself slumped in the chair as he read through the terse memo. He stared at himself, feeling empty as thoughts of his family eddied about him. "When this is over . . ." he thought. "When this is over . . ."

VII

"Orlowski's right, you are crazy," Wilkinson snorted. "How the devil are you going to traverse thirty miles of howling blizzard in this weather. That ground is probably half slush, half ice on the surface. It would take you a week in the middle of an August heat spell, providing you didn't drown in a sinkhole."

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"There's the Geepv," Ramillies said.

MacIntyre swung around to stare at him. "You are out of your mind! Even if you could get the thing off the ground in this wind, how the devil do you expect to find eight hundred square feet of building somewhere in several thousand square miles with zero visibility?"

"Cockpit lights and the compass," Ramillies replied, unperturbed at Mac's outburst.

"Like hell. Not tonight you won't. I just came down out of there, remember."

"We know the distance to #16 down to half a mile and we know the compass heading and the magnetic deviation. And besides, have you forgotten the beacon?"

Mac's face became a study in self-disgust. "Of course," he ground out. "The beacon."

"Aye," Wilkinson muttered, "if it's still working. What's to have prevented whoever breached the pipe from wrecking the beacon as well, or the line controls. I suggest that you check it out before charging up there."

MacIntyre nodded, ducked out into the wind-whipped night and sprinted across to the Geepv. He slid into the cockpit and pulled the canopy shut, then fed power to the avionic system. Shivering uncontrollably in the frigid cockpit, he waited while the radar warmed up and the screen glowed to life. Then he flipped the emergency beacon to the proper frequency for #16. Nothing. The silver-screen paled at him but no pulsating blip showed. Swearing, he changed frequencies for #15 and the sharp blaze of the beacon sprang into the lower edge of the screen. He tried #16 once more, then shut down and returned to the tent.

"Let's hope that whoever is up there hasn't decided to blow the station to kindling. The beacon is out."

"Interference," someone suggested. "Maybe we're down too low and the valley rim is causing a blackout."

"No chance, #15 is actually thirty feet lower and twelve miles farther away, but it shows up like a searchlight."

The silence that greeted the announcement held everyone in the tent in its dulling grip. Ramillies looking at the faces of the men, shivering in spite of the valiant little stove and the arctic clothes they wore, could almost feel the subtle tension that held a working team together dissolving. They were faced with an insurmountable problem; to repair a broken pipe spewing 75 million gallons of water per hour and now six feet below the surface of a small lake. They were not even able to take the first step —shutting off the water at the pumping station. He needed time to think, needed it desperately before they disintegrated into seventeen individuals fighting to stay

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alive. He decided to fall back on the Arctic explorers all-purpose cure to gain time and ordered Wilkinson to brew tea.

Ramillies sat back against the equipment, listening to the roar of the tiny flame fighting to transfer calories to the billy and turned his mind to the problem of how to get to #16. They had the Geepv and plenty of fuel. And it carried a rifle and pistol in the survival kit, plus the two rifles they had brought from the helicopter. So at least they should be able to deal with any intruders. But, how the devil to get there. On dead reckoning, after thirty miles they would be a quarter of a mile off course—at best. A quarter of a mile either way, a half mile possible error? If he could figure out some way to cut that distance down, it would be worth a chance. But half a mile—even five hundred yards—was suicide in this weather. Ramillies glanced at his watch, nearly eleven thirty p.m. . . . of course that was the way. The idea had struck him like the proverbial thunderbolt. With a proper relay setup, North American Air Defense Command, could drop them on the roof. Five minutes later, he was through to Thompson at Lake Superior explaining both the situation and what they needed. Thompson agreed and as soon as Ramillies was off the air, picked up his direct phone to NORAD Headquarters. Ten minutes more and a radar link, NORAD—Military Surveillance Satellite System—Norman Wells—the emergency repair camp Geepv was established and MacIntyre lifted off carefully into the teeth of a full-fledged gale.

VIII

Ramillies was in the left-hand seat with the radio. He had to shout to make his directions to Mac heard over the combined noises of engine and winds. As fast as he could, Mac took the Geepv up to ten thousand feet until the NORAD control voice came whispering through on the satellite relay.

"Pogo, this is NAADC . . . Vector Control . . . Pogo this is Vector Control . . . descend to six thousand feet and maintain a magnetic compass heading of 016° at two hundred knots for ninety seconds on my mark." The impersonal, almost bored tone of the voice contrasted strangely with the maelstrom raging around them.

Ramillies shouted the instructions to MacIntyre and on the NORAD controller's mark, tapped him on the shoulder.

"Pogo, this is Vector . . . Pogo, this is Vector . . . turn to 075° and ascend to nine thousand feet for ninety seconds."

The Geepv dipped sickeningly as the winds caught the craft forcing it over on its starboard side and down. Ramillies heard the high

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whine of the gyros mount to a muted scream. MacIntyre braced his shoulders and pulled steadily to the left on the control column, fighting desperately to right the Geepv. Sweat stood out on his forehead in spite of the cold and gleamed bloodily in the red glow from the instrument panel. The altimeter needle spun past four thousand feet and still the Geepv, caught by the brunt of the Force 9 wind was pressed Earthward. Ramillies unconsciously braced his feet against the firewall and gripped the edges of the seat tightly.

"Hang on," Mac roared. Then he cut the throttle back almost to idle and spun the gyros to line the Geepv up parallel with the ground. The craft lurched, flattened out and *literally side-slipped*. A Geepv has all the aerodynamic characteristics of a brick, depending on the brute power of ducted fan jet engine for both lift and propulsive thrust. As soon as the craft leveled momentarily and began its skip, Mac shoved the throttle to full Military-Rated-Thrust. Fan air rattled the lift ducts, shaking the craft. Simultaneously, the full force of twenty-three thousand pounds of thrust exploded from the ring burner into the turbines. Ramillies' head snapped back painfully against the head rest. The full thrust of the engines was too much even for a Force 9 wind and the Geepv rocketed forward. The altimeter, Ramillies saw, was beginning to wind back up from eight hundred feet.

MacIntyre now had the craft under control again, letting it fall off before the wind where needed as if it were a small sailboat.

"That was close," Ramillies shouted at him. He was limp and barely found strength to thumb the "mike" to transmit.

"Trite, but true," Mac shouted back. "You'd better tell those desk warmers we ain't got that much room for any more such maneuvers."

Ramillies nodded and watched the altimeter and compass. As they both moved toward nine thousand feet and 075° respectively, he began talking, telling NORAD what had happened, hoping the wild gyrations would have served to pinpoint them on the scopes.

"No luck . . . Pogo . . . we lost you below Angels 2 . . . hold present heading until . . . pick you up again."

For the next twenty minutes, the inane instructions poured in requiring the craft to twist and turn until sweat was running into MacIntyre's eyes and Ramillies was cursing steadily.

Finally, "Pogo this is Vector . . . we have positive identification on you. Descend to eight thousand feet and maintain heading of 355° until further notice . . ." NORAD now had them spotted using the infra-red sensor and radar surveillance gear in the MSS satellite streaking down across North Amer-

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ica from the Pole. Twenty minutes behind and three degrees latitude farther west came its sister satellite.

MacIntyre and Ramillies exchanged looks of pure relief in the red semilight from the instrument panel. Carefully, MacIntyre eased the Geepy around on the required course and they settled down to a ride worse than any Ramillies had ever experienced, even on the gravel and washboard Alcan Highway in late summer. The only thing lacking was the choking red dust. Even the constant clatter of gravel cascading up against the underbody from front tires was simulated by the rattle of the freakish winds against the cockpit. For twenty minutes, Mac struggled to keep the craft on course while the gale-force winds stubbornly fought to send it skidding sidewise in an end-for-end windmill to destruction in the frozen taiga a mile and half below.

Occasionally Vector Control broke in with minor course corrections, but other than that, only the agonized whine of the gas turbine engine filled the tiny cabin.

Beyond the thin perspex canopy, the wind-driven snow howled directly toward the craft, battering soundlessly against the plastic. Mac kept his eyes glued to the compass and altimeter, but Ramillies, with no such focal point to hold his attention, came dangerously close to falling asleep several times. The snow particles were driven like tracer bullets straight on and glowing in the running lights; they had the same peculiar hypnotic effect of blown snow against an auto window on a stormy night. The incessant streaks coming at him from out of the dark finally drove Ramillies, shaking his head constantly, to wetting his eyelids with a moistened fingertip, and shifting like a madman. To MacIntyre's unspoken, but intense annoyance, he found himself employing every trick he knew to stay awake.

Finally, Vector Control was on to them again with a final course correction. Ramillies acknowledged gratefully and all thoughts of sleep were now gone as the adrenalin of expectation pumped into his bloodstream.

Cautiously and with the engine throttled back as far as he dared, Mac began the descent. NORAD had advised them that they should be within less than one hundred yards in any direction of the pumping station. Even in a storm as intense as this, they should be able to see the one hundred thousand candlepower, red strobe marker light on the Pumping Station—unless of course, the saboteurs had gotten to it first as they had to the radar beacon.

Carefully, Mac eased he Geepy down, literally feeling for the ground as he peered over the forward edge of the cockpit. Ramillies saw the strobe light first and touched his shoulder; a moment

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later, Mac caught sight of the flashing red light and with a heartfelt sigh, turned on the Geepv's landing light and dropped gently in. As soon as they were down, the engines and lights went out at once. Immediately, the wind howl picked up, loud enough to make conversation, except by hand signals, impossible.

Ramillies checked the Winchester and levered a cartridge into the chamber, then eased the hammer down to safety. Mac followed suit with the survival carbine and at Ramillies grim nod, forced open the cabin hatch. The wind snatched it from his hands and slammed it back against the fuselage. Both men tumbled out quickly and were nearly knocked off their feet by the wind. They huddled against the Geepv for a long minute, adjusting to wind blast that snatched breath away. The Pumping Station was only a hundred yards away, but directly into the wind.

Given a clear, but moonless summer night without a whisper of a breeze, the two men would have taken great pains to move slowly toward the unseen bulk of the Pumping Station. That potential caution would be a headlong rush compared to their progress in the teeth of the bone-chilling wind seeping in from the Gulf of Alaska and the eerie red flickering from the strobe.

Bent almost double against the waist-deep snow, Ramillies and MacIntyre advanced on the pumping station. The beacon was now effectively shielded by the roof, leaving them in a reddish-gray darkness in which gusts of half snow, half ice-tiny crystals of biting glass—stung their faces and hands bringing a blessed numbness after a few minutes exposure.

Ramillies' outstretched hand touched something rough and icy —the building. Mac was at his shoulder seconds later. Ramillies drew his head down to shout into his ear, "Circle the building . . . I go left . . . you right . . . wait at air lock." Mac nodded and slipped away.

Ramillies as suddenly alone as if transported to the Moon, found himself listening intently for any untoward sound. But the howl of the storm drowned even the faint noise of MacIntyre's departure. After a few moments, he managed to shake off the intense dread that had momentarily held him immobile. With the damned thunder of wind in his ears, an elephant could have walked up and swatted him with his trunk, he thought.

Nevertheless, one hand lightly trailing along the wall, he moved resolutely down the long concrete block structure until he felt it fall away under his hand. He had reached the corner and for a brief moment he toyed with the idea of stepping around boldly. But then, discretion gained the upper hand and he moved back and stretched

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full length in the snow until he could peer around the corner, feeling somewhat foolish—and cold.

As he suspected, he saw and heard nothing but snow and wind. He moved forward in a half crawl, angling around the corner. When he had gone some ten feet and encountered nothing or no one, Ramillies got to his feet and not bothering to brush away the snow, moved forward again. At the next corner he repeated the process. Twenty minutes later he felt the hard metal of the air lock and a gun barrel jabbed into his stomach at the same time sending his cardiac output sky high.

"Pete!"

"Yeah. Find anything?"

The carbine barrel was withdrawn and Mac moved up to shout into his ear. "Nothing on that side . . . if they're here, they're inside."

Ramillies nodded absently, forgetting that Mac could not see his nod. "In that case, we have to go get them."

"I suppose so . . . Let's hope they're sleeping or something so they don't hear the air lock."

The interior of all pumping stations along the pipeline were pressurized as a simple precaution against excessive humidity—for which the Mackenzie Valley is famous. The banks of computer controlled switching gear and electronic instrumentation were all hermetically sealed. But seals have been known to fail. It had proved in the systems analysis studies cheaper and more efficient to carefully regulate both the temperature and humidity inside the station. To preserve the proper conditions within very narrow limits the building was pressurized to 15.3 psi, six tenths of a pound over sea level pressures of 14.7 psi. This completely negated the interfering effects from the surrounding weather conditions that more often than not, were characterized by violent extremes.

When Ramillies found the recessed panel and thumped the *open* switch bar, the red "in use" light shone brightly.

Both men looked at each other. "Someone's latched the outside door shut. Now what?"

At the same time, the red glow from the strobe marker disappeared.

"Think fast," Ramillies replied dryly. "We have to get in quickly. They know we're out here now."

Both men backed away from the hatch until they were hidden by the snow.

"You were taking some detasheet to Fort Norman, weren't you?" Ramillies shouted. "Is there any left?"

"Yeah, a whole case. I never did make it? Why? If you blow, the hatch in the decompression could wreck a lot of gear."

"I know . . . don't want to

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blow the door in. We can get up on the roof. There's a ladder on the west side. And, there's a ventilator for the dehumidifier in the roof. It's right over the storeroom. If we blow a hole in the roof there, the door between the storeroom and the rest of the building will slow the air when it blows out."

Five minutes later, Ramillies, his jacket stuffed with plastic-wrapped packages of deta-sheet, climbed over the lip of the roof and scrambled up onto the inclined surface. Very carefully using his pocket-knife as a miniature ice-ax on the slick surface, he climbed toward the dimly seen bulk of the air-conditioning housing.

A gust of snow kicked up near his outstretched right hand flinging slush back into his face. A second

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tiny explosion was even closer. He didn't wait to see more, but lunged for the retainer wall at the top of the roof line. This time he clearly heard the sharp crack and the dull clang as a third bullet bounced off the metal cover of the air conditioner directly over his ear. After a moment, he cautiously raised his head and peered over the low wall.

It was impossible to see his hand in front of his face, let alone the edge of the roof twenty feet away. He shifted his glance slowly along the unseen roof line, trying to adjust his eyes to the dead-black night. After a few moments, he thought he could make out the white surface of the snow-covered roof, when it was not lost in a swirl of gray snow. As far as he could tell, nothing showed either on the roof, or at the roof line. But there was no mistaking the fact that he had been shot at.

During the mad scramble up the roof, he had dropped the rifle, but he still had the revolver. And he could probably do as well with that anyway he thought. A hit would be a matter of pure luck. But first, Ramillies unzipped his jacket and removed the packages of deta-sheet. Deta-sheet, a commonly used plastic explosive compound, can be molded, packaged, and transported in just about any way imaginable. An amazingly stable explosive, Ramillies nevertheless doubted that it would be stable enough to resist a high-velocity bullet. And he did not intend to find out: not when *he* was carrying five pounds of the stuff anyway. Gingerly he piled it around the corner of the air conditioner, then settled down, revolver on safety and stuck inside his parka to prevent his hand from freezing.

Ten frozen minutes later, he thought he saw a dark mass shift slightly where he supposed the roof edge to be. He stared fixedly at the spot from the corner of his eye until he was sure. Slowly, the body —as that was all it could be— inched slowly over the roof line and began to move towards him.

Ramillies brought the revolver out and held it ready until it seemed that the body was beginning to resolve itself into the shape of a man crawling towards him on hands and knees. The wild swirling of the snow made it doubly hard to see. Even now he could not be sure that it was nothing more than an optical illusion brought on by his own anxiety. He waited through what seemed like an eternity. The wind-whipped frigid air seemed to peel the skin from the hand that held the revolver. During an instant's lull in the wind he heard the scrape of a boot on the ice- and snow-covered roof. Now, Ramillies could make out the shape of a body crawling slowly toward him. He pulled the hammer back from the safety position.

"Pete—it's me, Mac!"

Ramillies let out a long sigh of relief and eased the hammer back.

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Moments later, MacIntyre crawled over the retainer wall.

"What happened to you?" Ramillies demanded.

"Somebody took a shot at me," MacIntyre had to cup his hands and yell into Ramillies' ear to be heard. "It's all clear . . . I got him . . tell you inside."

Ramillies retrieved the explosive and began to lay a pound of it carefully around the humidity control vent pipe. Mac slowly cut and crimped the fuses in place, his bare hands stiffening with the cold, while Ramillies crawled back down the roof to retrieve the rifle from where he had dropped it by the ladder.

By the time he had reclimbed the treacherous roof, Mac had finished with the fuses. In the feeble light of his flashlight, Ramillies carefully checked both the placement and the fusing of the explosive. If this batch failed, they would have to try and find the Geepv again, or freeze to death on the roof. When he finished, he motioned MacIntyre back and told him to keep his fingers crossed. Both crawled to the other side of the retainer wall and crouched down head to head along its side, hoping that it would provide sufficient shelter.

"Ready?" Ramillies asked.

"Yeah, go ahead . . . uh," Mac laid a hand on Ramillies' arm, "are you sure you didn't use too much? We're pretty close."

"Fine time to think of that," Ramillies snorted and ripped the friction caps off the fuses, then buried his head in his arms, mouth open. Seconds later, the deta-sheet went off with a concussive crack that left them gasping for air.

Ramillies flung himself over the barrier and in one continuous motion swung down into the storeroom. As he dropped through the jagged hole where the vent had once been, through the cloud of dust and scraps as the air inside the storeroom billowed out, Ramillies hoped fervently that the dust and the lack of light would hide him if a second intruder was waiting. He rolled to one side as MacIntyre thudded down behind him.

The storeroom was full of dust and silence. Holding his breath to keep from coughing, Ramillies crouched silently and waited listening as hard as he ever had in his life. After several minutes, Mac pulled the flashlight from his parka, laid it on the floor, switched it on and gave it a kick to roll it across the floor towards the far wall.

Gradually, Ramillies' eyes became accustomed to the relative brightness cast by the flashlight. The storeroom was a shambles from the escaping air, but empty. Cartons were scattered as if by a miniature tornado and several large crates had been overturned as the excess air whistled through the narrow vent in the ceiling. Ramillies crossed the floor and with MacIntyre at his back, flung open the

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door. The long corridor leading to the living quarters and control room was empty. Wasting no time now on caution, they sprinted down the corridor to the control room and slammed inside, back to back, weapons covering the room.

Again nothing.

The entrance to the living quarters was only a few feet short of the control room. They repeated the performance quickly, only to find that room empty as well.

Mac nodded to Ramillies, indicating the air-lock entrance. The inside door was shut and latched and the operation light gleaming red indicated that the outer door was open. MacIntyre cycled it shut and Ramillies moved into position, his rifle leveled. As soon as the air was pumped in, he swung it open to find only traces of melting snow.

Wearily, Ramillies slumped down on the unmade bunk.

"Quite a bit different than night landings in Borneo, hey?"

Ramillies grimaced. "They must have left as soon as we blew the hole in the roof."

Mac studied the empty air lock for a moment. "One of them anyway."

Ramillies looked up. "Why one of them? You think there was more than one?"

MacIntyre glanced at him, seeing the tired, stubbled face peering at him from beneath the fur fringe on the parka hood.

"There has to be. Remember I said someone took a shot at me outside?"

"Yeah . . . ?"

"Well, I was about halfway up the ladder. Something smacked the wall next to me. I guess I was startled, 'cause I fell off the ladder. The fall knocked the wind out of me . . . which was a good thing, because our buddy must have thought he hit me. Anyway, he started climbing the ladder—after you. I finally got moving just as he was climbing over the top. So I let him have it . . . and I didn't miss either," he said grimly.

"Could you tell who it was?"

"Nope, too dark. Anyway, I came up after you. I think I twisted my ankle when I fell," Mac finished.

"Then, he must have been outside waiting for us—for a chance to pick us off separately, depending on the wind to cover the shots."

"With his friend inside in case we missed . . . only *he* chickened out."

"Now we're inside and he's out . . ." They both had the same thought at the same time.

Ramillies jumped for the air lock with MacIntyre crowding in behind him, slamming the inside door. Mac's hand stopped on the exhaust vent.

"Wait a minute. We couldn't find the Geepv in that stuff and neither can he. He wouldn't dare leave the shelter of the building or he would freeze to death."

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Ramillies let out a long breath. "I never thought of that. He doesn't know where we landed, or even how we got here."

He pushed open the slide set at eye-level in the door and peered out. "A few more half-cocked take-offs like that and we're dead," Mac growled. "He's probably out there right now waiting for us to come *out . . . bang, bang* and he's home free!"

Ramillies shivered, and not from the cold. "All right. Let's get the hatch to the storeroom sealed first."

As he started to turn away, he noticed the radio transceiver on a sideboard built into one wall. Several small puddles of water and traces of slush beneath the sideboard caught his eye. The glass faces of the dial were smashed in, the shards on the floor dully catching the light from the bare fluorescent tubes. Ramillies walked over to examine the radio and as he touched the front panel, it fell off onto the floor. Inside, the circuitry boards had been smashed as if with the barrel of a gun.

"Our boy seems to have a penchant for breaking things, doesn't he?" Mac picked up a piece of circuit board from the sideboard and tossed it onto the cabinet.

Ramillies grunted, "Come on."

Some twenty minutes later, they were surveying a similar ruin in the control room behind a metal panel marked EMERGENCY SHUTDOWN.

"That'll take all night to clean up."

"So far they have managed to strike in just the right places." Mac rocked back on his heels and with a grimy hand massaged his eyes. "What do you think, Pete?"

"Depends . . . depends on whether or not they had time to trace out the circuits as far as the switching gear. If they got that far, we're finished. This stuff is basically the linkage system into the network. We can trip the main switch manually . . ." While he talked Ramillies was busy with a pair of wire cutters clipping what few dangling leads were left. He pulled out the rack with a decisive jerk, slid it across the floor and carefully eased out another rack containing a rectangular mag switch bolted to the bottom of the rack.

"Hold your breath . . . ha . . ." Using the insulated handle of the screwdriver, he pressed down on the contact plate and was rewarded with a satisfying snap.

"Water's off, let's get some sleep."

"You mean that's all there is to it?" Mac said, startled. "From the fuss you were making, I pictured something about the size of a boxcar . . ."

Ramillies grinned at him. "Just a regular ol' magnetic switch. See this spring here beneath the plate. Well, current comes through this coil here which makes it a magnet. The magnetic force pulls the plate

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down making contact. Once that happens, a coded message is sent to the computer in the form of electrical pulses instructing the pumps to shut down. When the pumps stop, the water velocity slows normally and by the time the water level drops, there is no danger of ripping the pipe apart. It backs up north of here and out through vents to be dumped into the Mackenzie at a metered rate. The rest of the water flowing in the pipe south of here will be slowed to empty out at the break at one-eighth flow."

Mac nodded. "O.K., I see that, but how did they bugger it up so that it can't be controlled from Superior?"

Ramillies stood up and shut the panel hatch. "That is one good question. It could be something as simple as cutting the LDX lines, or as complicated as suppressor circuit hidden somewhere in the innards. I'm not a computer technician and so I'm not even going to try and find out." Ramillies paused and stared at the panel. "One thing's sure, whoever tried to wreck the line wasn't either."

"How do you know?"

"Because if he was, he would have just inserted a small bomb. There are too many back-up systems and alternate routes that he would have seen right away. A bomb would have wrecked the whole system and taken days to replace."

Mac nodded thoughtfully. "It's strange he didn't do that."

Ramillies grinned tiredly. "Yeah, it is. I would have just shoved a bomb in. I guess whoever hired these characters, will pick better ones the next time."

Mac scratched the back of his head. "I'll bet he will . . ."

From the sound of Mac's easy breathing, he had fallen asleep quickly. But Ramillies lay awake on the hard bunk, sleeping bag thrown loosely over his body for nearly an hour in spite of his weariness. Like Thompson's his mind had been running at full tilt, over and above the immediate requirement for action, seeking to puzzle out who might be behind the attempt to wreck the pipeline. From the scope of the operation that they had seen so far, he doubted seriously that it was the actions of a small group.

The sabotage points were too widely separated. At least a helicopter would be needed. Not only were they expensive, but the RCMP kept a pretty close watch on all aircraft within two hundred miles of the pipeline. That meant a long flight in by 'copter from outside the zone, and 'copters like that cost money either to buy or to rent.

Wrecking the line completely would be disastrous to the United States and put a big hole in Canada's economy over a number of years. But small time damage like this would be negligible. The United

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States had to have the Canadian water as a first step to developing the liquid resources of Alaska. But, the effects of any potential great loss would not be acutely felt for at least twenty years. And even if the entire two hundred mile stretch of pipe were wrecked, it would take less than half a year to replace and the cost certainly wasn't going to break the company. Besides, why blow only one pipe of the two being used? Why not both, or even all six?

No, it was something beyond that. Someone did not want the line operational. Although why they waited until it was finished and water flowing, was beyond him. Ramillies considered the effects of public opinion when news of the break was released. Surely Canadian opinion was never very positive about selling Canadian water, but resigned to the beautiful economic benefits. The United States public on the other hand had gradually been convinced of the benefits that would accrue from the vast expenditure even without the threat of the drought to prompt its construction. Ramillies doubted that news of a pipe break in the hinterlands of the northwest territories would prompt the tax-paying public to do more than demand better security measures; no, there was another reason than that behind the sabotage.

Who on the international level, he wondered. The U.S.S.R. Perhaps, but doubtful. One, they would not take a chance on getting caught. Two, the gains were not impressive enough. The cold war had been just about over for nearly twenty years. Economic warfare seemed to be the new style of international conflict nowadays and was played on the diplomatic and trade levels. This was the type of "war" that Ramillies liked. The desperate quest for new and ever better markets in which to dump the new *junk* of two highly industrialized nations not only provided impressive benefits to the eastern and western cliques but the entire world supposedly gained; and perhaps more than the actual antagonists. At least Ramillies liked to hope so.

Red China, now, was a likely candidate; but again, what had she to gain? She couldn't hope to divert enough United States troops and money from the Containment Line around her borders into the Arctic to guard the pipeline. And with the softening in Red Chinese tactical objectives in the past four or five years paralleling that of the Russians thirty years ago, again he doubted if this was the answer. That left him with the *Southeast Asian Combine*. And that made a heck of a lot more sense.

Japanese industry had forced the country into becoming the leading nation in the ten-year-old industrial Combine. Building on previous Japanese acquisitions, the Combine had acquired a sizable investment

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in Alaskan oil and mineral corporations. The public outcry against a foreign exploitation of American natural resources prompted by the neo-isolationists was growing. Perhaps the Combine feared the alternative prosperity the pipeline would bring once it was extended into Alaska. Prosperity that would eventually force them out.

Ramillies yawned and turned restlessly. That line of reasoning was a little farfetched, but. . .

Disgusted with his sleeplessness he got up and prowled into the control room. The external TV cameras showed nothing but dead black night, spotted with dimly seen trails of white as snow swirled past the night-light lenses. Convinced that the storm was not about to ease up, he returned to the cot and eventually fell into a restless sleep, filled with dreams of international spies.

IX

". . . And that's the extent of it. We still don't know whether there was just the one Mac shot, or if there was another that got out of the building ahead of us to a Geepv or 'copter." Ramillies' voice was tiny and distant, broken often by static.

"Any sign of whomever it might be that is responsible?" Thompson asked.

"No. They left nothing at all in the station. That man was Caucasian, dark-haired, about five-eleven and probably weighed about one hundred and seventy pounds. No identification . . . labels or papers. He could have been an American, a Canadian, a Russian . . . anyone or anything."

"Damn," Thompson muttered. "Ottawa and Washington are raising hell over this. The Prime Minister and the President have been patient so far, but . . ."

"Well, it's my guess . . ." A long burst of static interrupted and Ramillies stopped and waited for it to clear. "It's my guess that whoever is behind it, hired a bunch of local bully boys to do their dirty work. So even if we get hold of one, it probably won't do us any good. He won't know who is paying him ultimately."

"You are probably right," Thompson replied wearily. "Do you think there are more around?"

"Yes, I do . . . get here somehow. And so far we've seen no sign of a Geepv or 'copter . . . new snow up here, but not enough to hide anything that big. So that leaves two choices. Either the guy who was left had someway of calling someone in to pick him up or else . . . waiting for him to pick them up and the storm dropped down too fast. If that's the case, we're safe . . . next couple of days. It will be almost impossible to get in there without the kind of help that we had from NORAD."

Thompson drummed on the desk

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top with his fingers. "What's the weather like up there now?"

"Cold. Temperature is down to the minus twenties with fifteen to twenty mile an hour winds." A long burst of static washed away his voice and Thompson thought for a moment they had lost contact. ". . . Boys got the channel cut and we blasted the retainer dam about eight hours . . . water should . . . away by tomorrow" Another long roll of static followed, then ended suddenly and Ramillies' voice boomed from the desk speaker.

"Once we get the water drained we can weld the new sections into the line. If everything goes all right, we should have water flowing again in thirty hours at the most."

"Thirty hours," Thompson groaned. "That's cutting it pretty fine. The Lake la Martre Reservoir will only hold out for another thirty-four hours. After that, suction is going to rip the pipe to pieces as the water moves south."

Ramillies' voice followed harshly. Thompson could picture the face behind the voice and knew that he would not have cared to be found the guilty one by Ramillies. "Whoever dynamited this section of the line knew what he was doing. Just blow one pipe and suction will eventually tear forty miles of line to pieces . . ." Static broke in earnest and after several minutes, Thompson shut the speaker off. There was nothing he could possibly tell Ramillies that he did not know already. So far, the only thing they had gained was to get the water shutdown and the channel cut. Now the real work began. Work that could not be shortcutted, work that required the brute strength of the pipe crew to cut, chivy into position, and weld; in short rebuild a section of twelve-foot diameter pipe that had been first laid by machine.

So Ramillies had thought, too, several hours later. The job of laying the pipe through more than nine hundred miles of Canadian wilderness had called for work. The job of repairing the pipe also called for work; work, work, and more bone-breaking, exhausting work that required more than endurance and strength: required all of the dedication and morale that men could muster. He had the men, men who had already expended a superhuman effort in cutting a hundred feet of channel through solid rock in thirteen hours of night and intense, storm fought effort with only hand tools and explosives made unstable and extremely dangerous by the cold.

Now, standing on the rocky ledge above the pipe, he cursed steadily and fluently as he watched the last of the rocks and mud slide into the narrow channel. For long moments, an all-consuming anger had filled him while the avalanche of rock, mud and snow cascaded

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down the northern slope to create a mass of rubble that effectively damned the water flow. Ramillies looked down at the gray shape of the top cell of pipe, only just beginning to appear above the surface.

Minutes before, he had heard an explosive crack high on the slopes above them, followed by the long, drawn-out rumble of the slide. As one man, the camp had broken from their sleep gear and the tents and now, clad only in boots and underclothes, some merely with blankets thrown around their shoulders, they stared down at the rock dam, completely unmindful of the cold and the wind-whipped snow. A gut-twisting sickness filled Ramillies as he watched the pipe-fed waters already building again behind the rock slide. Of a sudden he felt a deep weariness that struck him to the core of his body. They were licked and licked for good. There had been a second and perhaps a third saboteur after all and one of them had followed from the pumping station. Or perhaps he had been here before, waiting, watching their snaillike progress to save the pipe line, laughing at the pitiful spectacle of the twelve men trying to undo the damage he had caused. When they had appeared on the verge of success, he had set an explosive charge that wiped out hours of effort. Or perhaps, the unknown saboteur was in the repair party, flown in undetected with the repair gang from Area V. Either way, it did not seem to matter any longer. With hand tools, there was no way to clear away the small mountain of rock now lying in the channel.

He turned away from the clogged channel, shoulders sloping in defeat to return to the tent and the radio. He hardly noticed Wilkinson peering intently at the rock slide, or that he was climbing down on the crest of the rock ridge to examine it more closely.

He was nearly back to the tents before he became aware that Wilkinson was waving and shouting to him. Ramillies shook his head, then turned back. Wilkinson waved again and he stumbled to the slope.

"Pete, look out there . . . there at the way the rock has slid into the channel." Wilkinson was pointing a dirty finger at the far side of the channel. Ramillies followed the line of his finger to a jumble of rocks.

"Whoever set the charges," Wilkinson called, "didn't know much about explosives . . . the far end of the dam is full of large boulders. He should have used the TNT, but I'll bet he didn't. We should be able to set charges and blow a narrow gap through the rock. Maybe the water will clear the rest of the path by itself."

For a long moment, Ramillies stood in sick despair before Wilkinson's words penetrated. Then he,

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too, examined the way the slide had come down off the slopes from both sides. Suddenly it struck him that Wilkinson was right. The smaller pieces of rubble, blasted off the slopes first, filled the narrow channel near the base and along the foundation. As the slide had grown, it had pulled the larger boulders with it as it ran down the slope. The largest boulders, the last to be knocked loose and the first to arrive in the channel formed the center section. It just might work . . .

"Come on," Ramillies flung at him and sprinted down the slope and out across the dam. Wilkinson was right behind him and MacIntyre seeing the two running down the slope broke away from the knot of angry men and pounded after. Ramillies danced and jumped from rock to rock across the dam until he reached the center, then he and Wilkinson climbed down to the water line several feet below the crest. MacIntyre slid after them.

"What the hell . . ." he started. Ramillies quickly explained Wilkinson's idea and Mac's face sobered. A brief glimpse of anger crossed his face for a moment to be replaced instantly with a grin.

"It just might work. But, who could have set the charges," he asked, looking questioningly at the other two. "I thought we left our friend freezing in the snow at #16. There's no way in the world that he could have gotten down here so fast unless he had a 'copter or Geepv and with the blizzard . . ." he let the sentence trail off. "Unless . . ."

"Unless," Ramillies interrupted, turning to look at the group of men clustered on the slope, "he's got an accomplice down here."

Mac stared at Ramillies. "So there are two of them?"

"Yeah, or three or four. Who the devil knows." Ramillies stared at the men. Wilkinson clutched a sleeping blanket around his shoulders, but Mac had stopped long enough to grab both jacket and gloves.

"There's been too many funny things going on," Ramillies said slowly. "Too many well-planned and coordinated acts of sabotage. This thing was meant to look like a rock slide. But, like Wilky says, whoever set it off didn't know much about explosives. The explosion was too loud. We all heard it and I'll lay odds that when we check we'll find a couple of pounds of deta-sheet missing—and the TNT untouched."

Mac nodded. "O.K., then we better have some kind of a question-answer period when we get this thing cleared up." He turned to Wilkinson. "Wilky, how do you figure to go about this?"

Wilkinson paced off about five feet as best he could on the jumbled rock surface of the dam. In his thick brogue he explained. "There are three chunks of rock

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here that form keys to the entire structure. From the looks of them, they extend the width of the dam, or pretty nearly so. Whoever planted the charge used the wrong explosive in the wrong places. The charges should have been set close to the surface with short spaces between. That would have broken the rock into rubble and then it would be almost impossible to clear the channel. But it looks like he used just a few charges that lifted the rock. Now it's like a log jam. If we plant sizable charges under each of these three key rocks, enough to shift them several feet, we'll be able to break up the structure. The water will do the rest."

"All right," Ramillies snapped, "let's get going. Get everybody dressed and working. Mac, you get a rifle. We're going to make sure this doesn't happen again. Let's move."

An hour later the charges had been set and Orlowski and Wilkinson had strung the wiring to the battery. The work crew crouched high on the slope near the crest and Wilkinson blew the charges. He had packed several pounds of TNT beneath each of the three keys and as the explosives went off with a muffled rapid-fire roar, the smallest of the keys sailed up several feet and tumbled down the slope into the water, creating a ten-foot geyser. The other two larger rocks shifted then flew apart as the water caught and tore them away. Wilkinson watched carefully as the torrent swept through the gap and flung itself down the narrow channel. As the stream of water cascaded through the venturilike gap in the slide it bounded and smashed at the retaining walls of the channel, tearing away the loose debris of the dam. In seconds, the torrent of muddy water had cleared the ice and rock away and poured it down the channel toward the open tundra beyond the valley.

Ramillies stood up from where he had been kneeling with the rifle across his knee. He let it rest loosely in the crook of his arm and watched the stream of water cut away at the rock slide. Several feet away he could see MacIntyre doing the same. He shifted his eyes away reluctantly, his face setting itself into grim lines of anger. The construction crew was standing silently watching water begin to flow out of the basin. There was no jubilation from the group of men, only an angry silence. Ramillies announced earlier that one of them was the saboteur. Now they stood quietly, faces angry, not talking to one another, each mindful that the man next to him could be the saboteur, now desperate at having failed for the fourth time. The fifth attempt might be aimed at their lives.

"All right," Ramillies shouted above the rumble of the water, "let's get those pipe sections ready

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to weld. That water will be low enough by evening."

At two o'clock that afternoon, Ramillies kicked over a carton of epoxy cans. The half-dozen five-gallon containers fell from the pallet and went rolling across the tent floor. Orlowski picked one up and saw that it had been punctured, allowing the epoxy to set.

Wilkinson and Orlowski stood by silently, watching as Ramillies went through the cartons stacked on the pallet, swearing savagely as he found each can punctured. Against the tent wall, he found one unopened stack of six cartons, thirty-six cans in all that had been missed, nowhere near enough to complete the welding. Half hidden beneath the cracked wood of the pallet where it had been carelessly thrown was the small crowbar that had been used to puncture each can. Gobules of the ready-mixed epoxy had set firmly around the point and shank.

From where he knelt by the pallet Ramillies said wearily, "Whoever did this must have done it before setting off the landslide. This epoxy takes about three hours to set up solidly."

The other two nodded. "He wasn't taking any chances, was he?" Orlowski said grimly. "And it sure looks like he's got us now."

Finally, Ramillies threw down the crowbar and stood up, frustration and defeat appearing in his slumped shoulders. He nodded. "You're right, that does it. They've won, whoever they are. Without that epoxy, we're licked."

He was silent a moment, listening to the steady keen of the wind outside the tent. In the last two hours it had begun to snow again, harder than before. In a matter of minutes it seemed, the tents and equipment were mounded over with soft snow, snow that also piled up against the windward side of the tent and everything vertical. The wind cut like knives through even the Arctic gear the men wore until their faces became pinched and bluish. Inside the tents, with the heaters on low to conserve the meager store of fuel, the temperature was barely above freezing.

What had been an inhuman job before, Ramillies knew, had become virtually impossible by now. He thought of the water level in the line reservoir, sheeted over with broken and jumbled chunks of ice, steadily sinking lower as 312,500 gallons of water pumped steadily down and out the broken pipe every second; even at reduced flow.

He went to the tent flaps and stood looking out at the skeletal black structure of the derrick against the swirling gray sky. The empty, useless derrick seemed to symbolize his own bone-weary body.

Three hundred miles north, two men kept watch on the water-level

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gauges for the Lake la Martre Holding Reservoir. In twenty-four hours, the water level would sink below the turbine inlets. When that happened, air would be sucked into the whole three hundred mile stretch of pipe behind the retreating water wall. As it did so, the currents and vortices set up by the tremendous speed of even the reduced water flow and the resulting suction would begin ripping the pipe to pieces. When Lake la Martre was emptied, the line from Great Bear would have to be shut down on both ends to preserve the three hundred mile stretch of pipe between the two. They then had less than fourteen hours calculated before those millions of stationary gallons of water would begin to freeze in the pipe from Great Bear, accomplishing the same destruction

Each avoided the other's eyes. They knew the situation was hopeless unless the stretch of blasted pipe between pumping Stations #16 and 15 could be repaired. Clipped to the control panel was the flimsy with Ramillies' terse message: "Epoxy destroyed."

Thompson had never felt so old in twenty years of continual battling as he did at this moment, sitting at his desk staring at the same message from Ramillies. Everything was conspiring against them. The unknown saboteurs even seemed to have persuaded the weather to act in their behalf. With the late spring blizzard still raging up and down the Mackenzie Valley, there was no possible chance of getting another shipment of anything into the work crew until it let up.

At the Prime Minister's suggestion, he had started a sno-cat train overland from Fort Simpson, but with two hundred and fifty some miles to go, in a howling blizzard and some of the ruggedest country in North America to traverse, it would take them at least three days.

Thompson reached for the phone on the desk, then dropped his hand. There was nothing to be gained by trying to get through to Ramillies again. If he came up with a way out, he would let him know soon enough. He might as well face it and resign himself to losing the forty-mile stretch of pipe between Lake la Martre and #16. He picked up the phone and spoke tersely to his administrative assistant.

"When the water level gets down to fifty feet at Lake la Martre, shut down."

The assistant on the other end of the line was surprised at the uncharacteristic weariness in the chief's voice.

"Yes, sir. What about Great Bear?"

"Let her flow until Lake la Martre is full. That should give us an extra two or three days to keep water moving through the line. After that bleed the stuff out onto the tundra.

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I'm not going to lose three hundred more miles of pipe," he finished angrily. Then in a quieter voice, "Also warn Ramillies and his crew two hours before you shut down to give them a chance to pull back."

Thompson put back the phone and swiveled his chair to stare out the window. It was night again, the third since the first word of the break had come in. In all that time he had barely moved from the desk. Now, the first edges of the blizzard were beginning to reach the lake as a mixture of snow and rain whipped along by strong winds. By morning, the snow would be several inches thick and a dirty gray under the lowering sky.

He massaged his weary eyes with long, thick fingers and considered leaving for his suite and some sleep. But he couldn't bear to leave now, no matter how hopeless the situation and he compromised by stretching out on the couch. Thompson was asleep in seconds.

Ramillies sat hunched forward on the edge of a skid, smoking and oblivious to the cold. His mind was churning with various ideas all of which he discarded as fast as he thought of them. Overall, as a kind of counterpoint to his thinking was the pulsing knowledge that they were licked, completely beaten. The lake in the valley catch basin had drained quickly and now ran as a steady stream fed by the seemingly inexhaustible pipe, running at only enough pressure to prevent air from flooding back into the line. The repair pipe and the mobile gantry waited above the break needing only his orders to be epoxied into the gap. Epoxy. Without that, there was no way of welding the temporary plastic pipe into place until a full-fledged repair gang could get in to make the repairs permanent. Ramillies sat staring through the cigarette smoke at the crew with torches cutting and trimming the broken ends of the pipe in preparation for the repair joint. Orlowski had felt, and Ramillies agreed, that it was better to keep the men working than to let them sit around speculating as to which of their number was the saboteur. They needed no fights or quarrels among themselves at this time; additionally, it would keep everybody where they could be seen at all times.

Wilkinson dropped down on the pallet beside him. "Pete, would you say we have enough epoxy to weld one pipe joint solid?"

Ramillies dropped his cigarette and ground it into the snow with his heel. "One maybe."

"Enough to hold," Wilkinson persisted.

"Yeah, I guess so. As long as the pressure is kept low."

He sat in silence for some moments, then turned to the burly Scot. "What have you got in mind?"

Wilkinson hesitated. "I don't know if it would work or not . . ."

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"Come on, out with it," Ramillies snapped.

"Well . . . those repair pipes have an eight-inch collar. You shove the collared end onto the broken metal pipe, fill in the collar with epoxy and clamp it down tight. The connectors have collars on both ends. Now, we need three lengths of pipe to fix the break . . . that's two lengths with double collars and one with a single collar. That means we have to fill four joints. And we have only enough for one joint."

"So?"

"A long time ago, I worked for a construction crew in Winnipeg, laying sewer lines. Back then, they still filled the joints with melted lead. Before you poured the lead in, you tamped a wool cord into the collar to make a tight seal and an anchor for the lead . . . just like caulking a boat. You pound in caulking cord between the planks and pitch over it."

Ramillies swung round at Wilkinson. "You mean we should try the same thing here?"

"Yep." He pulled out his pipe and filled it, then touched a match to the bowl. When it was drawing to suit him, he shook the match and tossed it away before continuing unhurriedly. "We have the two tents, the sleeping bags and so on. There ought to be enough material to make caulking cord and enough epoxy left for a thin seal in the four joints. If we clamp the pipes together tightly enough, we should be able to make do, for a few days anyway."

While Wilkinson puffed reflectively, Ramillies turned the proposal over in his mind. He could find no loopholes in the mechanics; the only question was whether or not the jury-rigged joints would withstand the pressures of the million gallons per minute in the cell. If they could clamp the joints strongly enough, they might do it. And they had enough cable to do that job.

"And," Wilkinson added quietly, "there's certainly nothing to be gained by sitting here feeling sorry for ourselves."

Ramillies grinned sourly. "Chief, you sure hit it there. The water is flowing at a quarter flow now. If we get Thompson to cut it back still further just enough to keep water moving, the jury rig should hold."

Ramillies paused a moment, his mind churning furiously with the details. "All right, let's get to it."

They called Mac over and he slung the rifle he had not put down since the landslide and hunkered down to listen without comment while they explained. Orlowski joined them and they repeated Wilkinson's idea again. Both men thought it might work. MacIntyre's eyes narrowed as they went through the plan again, and his face was grimly set by the time they were through.

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Orlowski trotted down to the beach to select a crew to begin *cutting up the tents.* Ramillies, Wilkinson and MacIntyre went into the tent to the single remaining stack of epoxy cartons.

"Mac," Ramillies's voice was measured, "I want you to cock that rifle and sit on the stack until we're ready for it. Anybody who tries to get close without my permission, gets a bullet. Understand?"

MacIntyre nodded, levered a cartridge into the chamber and sat down.

During the next two hours, work went ahead feverishly. The torching crew began preparations to swing the pipe sections down as needed. The remaining six men along with Orlowski and Ramillies, went to work on the tents and sleeping bags under Wilkinson's directions, cutting the heavy canvas into long rectangles, laying the shredded sleeping bags to form a padding, then rolling the canvas into long tight tubes.

Two heavy floodlights lit the area, cutting through the swirling snowfall and highlighting the stark skeleton of the derrick, turning the solid, but now thinner bar of water into a stream of quicksilver. Two winches with spidery lines were anchored solidly in the frozen mud, ready to pull the first of the pipe connectors into position against the jagged end of the ruptured steel alloy. By late afternoon, they were ready to start welding pipe.

X

A persistent buzzing filtered through Thompson's sleep. It took several moments for him to wake enough to realize it was the phone. He stumbled across to the desk and fell into the chair, then picked up the phone.

"Supervisor Ramillies is on, sir," the administrative assistant announced.

"Put him through."

Ramillies came on the line and for once the static was minimal. He quickly explained to Thompson what he had in mind. "Hope" that was what immediately came through to Thompson. In spite of his fatigue, the older man was instantly alert. He asked for a time estimate to complete the work and got it.

"Eight hours, that's too long, Pete." Quickly he told him about the condition of the Lake la Martre Reservoir. "If we had Great Slave operating properly, we could do it."

The clock on his desk read six p.m.—four hours to shutdown for Lake la Martre. He could stretch it another hour. Any longer and he risked losing the three hundred mile stretch between Great Bear and Lake la Martre.

"O.K., we'll do it."

"Will the joints hold?"

"They will for sure," Ramillies said, "if you cut the pressure from #16 on down as low as possible. Otherwise, I doubt it."

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The hope that had been reborn in Thompson died quickly. "That does it then, Pete, I'm afraid. We still have no control over #16. I still show a red light on my board. They must have cut the transmission links somehow."

There was silence on the other end for a moment. "Then we'll have to go back up to #16 and shut it down manually."

"Can you be that lucky twice in a row," Thompson demanded bitterly. "The last time was too damn close. I'd rather lose three hundred miles of pipe than the best supervisor I've got. You stay where you are. That's an order."

But a hollow click told him that Ramillies had signed off. For the first time, Thompson felt fear, great gagging sensations of fear that caught and twisted his stomach, causing him to retch. Ramillies was going and there was nothing he could do to stop him. And his outburst had fixed things so that he would go without even NORAD to guide him. Although he knew it would do no good, he ordered the transmitting center to reestablish contact with the repair crew. But he knew that they would not answer until Ramillies had left.

Ramillies waved to Wilkinson and Orlowski to join him as he sprinted across the ice-hard ground to the pallet where MacIntyre sat grim as death. He explained quickly about the need to return to #16 and operate the control valves manually and about Thompson's orders to stay put. All three agreed with his decision and Mac tossed the rifle to Wilkinson. Five minutes later the Geepv was airborne and for the second time in twenty-four hours was bucking the fierce crosswinds as it headed north northwest.

The overcast winter sky blended imperceptibly with the snow-covered surface below. Try as he would, Ramillies could discern no effective horizon. Even if there had been afternoon sunlight bright enough to penetrate the cloud cover, the semiblizzard would have shut down visibility to effective zero anyway. The flat, unbroken expanse of rock would have been completely whited-out.

MacIntyre was flying by altimeter and compass, barely sparing a glance out the canopy. Harsh and silent, Ramillies strained through the binoculars for a sign of the snow-covered pumping station.

This second flight was incomparably easier than the first. MacIntyre had a definite compass heading to follow and the winds, while gusty, were low enough to allow him to adhere to the fine needle holding steady at 355° North. After twenty minutes of flying time, he glanced at Ramillies and indicated with his thumb that he was going to begin circling to the west in a radius less than a mile across.

Ramillies loosened his seat belt

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and hunched as far forward against the canopy as he could. Mac dipped the nose down and began pulling the Geepv around in a tight turn. Even at eight hundred feet, Ramillies could not make out the snow-covered terrain. He twisted and turned, pressing against the canopy. Twenty minutes later, Ramillies caught sight of the pumping station beacon. The small black circle where they had blown in the roof showed faintly in the fading light against the white background.

Dropping in low for the approach, the two men could see the drifts piled against the building on all sides, indicating the fierce quartering of the winds near the ground.

The Geepv dropped in less than twenty feet from the air lock. As Mac cut the engine, the craft settled gently into the snow. In the sudden silence Ramillies' voice boomed unexpectedly.

"Doesn't look like anyone's been around to pick up the body."

MacIntyre grunted and leaned forward, arms resting on the controls. He stared blankly at the snow-shrouded building.

Ramillies slung the radio over his shoulder, pushed open the door and jumped down. He held the rifle loosely cradled in his left arm, right hand grasping the stock, finger resting tensely on the trigger. He wasn't expecting trouble, but then . . . He moved carefully through the knee-deep snow. The sound of Mac's hatch opening was the only sound in all that white desert.

"Stop, Pete." A voice neither loud nor harsh, only steady and without a trace of emotion, seemed to hang in the frozen air. Ramillies knew it was MacIntyre.

In the time it took the two words to die in the frosted air, Ramillies knew; all the unexplainable and impossible acts of sabotage were suddenly clear to him. The suddenness of it took him by surprise but so great was his anger against the person or persons responsible that his body, reacting smoothly, well in advance of his mind, turned slowly, the rifle not shifting an inch from where it lay across his arm, except to droop slightly until as he came halfway around, it was pointing at MacIntyre's chest. The rock-steady .357 Magnum survival carbine from the Geepv stared at him in return.

An eternity passed, flickering by in the drop of an eyelash. The two men stared at one another across twenty feet of snow-filled air.

Ramillies exhaled the breath he had been holding; it felt as if he had stopped breathing an hour before. "I don't believe it."

"Neither do I." MacIntyre, his eyes hooded against the swirling snow, nodded with his head at the rifle Ramillies held. His voice was bitter and somewhat lost. "Drop it, please."

Ramillies did not move to comply. Rather, he stood as he was, feeling his stomach tightening. The

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tension between the men almost crackled.

"You were the one who punctured the epoxy cans, weren't you? You also set off the landslide. You were the only one with gloves and boots afterwards, weren't you?"

Ramillies' voice was steadier by far than he felt. As he continued to talk, he felt his body begin to relax, little by little. He knew that the time for death had come, just as it always had in the Borneo jungles: first, the gripping tension that mounted steadily to the retching point. Then as the quarry approached, the rush of adrenalin that carried through the firing, to be followed by the empty draining as the adrenalin broke down in the bloodstream and the composite chemicals were washed away.

Ramillies watched MacIntyre's face as he talked.

"You blew up the pipeline, didn't you? That's why you were out in the Geepy that night and so near. The storm caught you by surprise; just like the rest of us. You were lost until you heard us talking with the RCAF freighter."

"Last warning, Pete. Drop it," Mac repeated patiently.

Ramillies ignored him. "You shot at me last night, didn't you? And when you saw you had missed, you faked the fall from the ladder before I could turn around and cut loose. You weren't about to get yourself shot at that point. Instead of being shot at, you shot your friend. He was really working for you, but then you couldn't afford to have any witnesses around. How does it feel to be a murderer, friend?" he asked suddenly. "Then, of course, there was the slush beneath the radio. After you shot your friend, you went back in and smashed the radio."

The wind had begun its restless questing across the frozen wastes. As it blew around the bulk of the power station, it developed an eerie whine that resembled the howl of a starving wolf far in the distance. Involuntarily, Ramillies shivered in its icy grip.

"There was no way that you could get at me on the roof after that shot. You knew I would be up there waiting. But you had to have some excuse to explain those shots. And, you could not have waited for me to freeze to death because that would have taken too long and in any event, you might have frozen first. I had more shelter than you did."

Ramillies paused for breath. MacIntyre still had not moved. His face was worse than implacable, it was entirely empty of any emotion.

"Why, Mac?" asked Ramillies.

MacIntyre stared at him, a faint tinge of surprise coloring his face.

"For money. Lots of money."

"From whom, the Southeast Asian Combine?"

"No." MacIntyre shook his head slightly. "A private group . . ."

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"Yeah, I'll bet. A private group with a lot riding on the destruction of the pipeline before it extended into Alaska and with connections inside the Combine?"

"It doesn't make any difference now. Let go of that rifle. If you cooperate you can still . . ."

" . . Get out of this alive," Ramillies interrupted. "No, I don't think so. You must have some way of getting out of here using that Geepv, somewhere to go. And, that doesn't include taking along any companions, especially unfriendly ones. If you want to get out of this alive, you'll have to kill me."

"Suit yourself . . ."

Two men with rifles. Not an incongruous sight for the Arctic where death always crouched patiently. Both men were tensed for the crash of the first bullet. It had to be the first bullet and it had to count. There would be no time to fling oneself heroically aside as the other weapon roared. Unless that first bullet struck to cause instant death, a reflexive touch of a trigger would kill the other. Both weapons were capable of smashing the heart or the head; the only two targets on the human body that could both cause death and immediately shove the already dead body far enough off balance to spoil the aim of the rigid arm.

Briefly, Ramillies wondered what had possessed MacIntyre to allow him to complete that turn that brought his rifle to bear . . . a good friendship, a friendship that was sometimes stronger than any ideological feeling, any human greed. MacIntyre had to kill him to save himself, but he could not murder a good friend.

As Ramillies fired, he felt deep sorrow for MacIntyre. He had never suspected the depth of weakness in the man that would lead him this deep into betrayal. His rifle cracked viciously across his arm and his body was already starting to move to lever a second cartridge into the chamber—an unneeded cartridge—as MacIntyre's bullet lanced his cheek to the bone.

Ramillies was thrown to one knee, twisted by the bullet's impact so that his back was to MacIntyre. He cringed, waiting for the second bullet that would collapse his existence. But it never came.

Ramillies took a deep breath and scooped up a handful of powdery snow and pressed it to his cheek. Then he slowly stood up, suddenly a tired man. He turned.

MacIntyre lay in the snow like a rag doll. Ramillies walked forward and stood over him. Already, the cold was beginning to congeal the blood from his shattered face. There was nothing recognizable to Ramillies in the body that lay at his feet.

Ramillies turned and went into the pumping station to shut down the water flow and make his report. ■

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P. Schuyler Miller

the reference library

ODYSSEY OF AN IDEA

By the time you read this, many or most of you will have seen the Stanley Kubrick film "2001: A Space Odyssey." If you haven't, you almost certainly will. Technically, it is certainly the most advanced science-fiction film we have ever had. It has also turned out—as its producer/director intended it should—to be one of the most controversial. I would consequently like to pass on to you the recommendation of a reviewer in the New York *Times*: See the film—then read the book, and find out what Arthur Clarke intended it to mean.

In fact, you may want to read two books: the novel based on the screenplay (New American Library, N.Y.; 221 pp.; $4.95 and Signet Books, N.Y.; 221 pp. +16 pp. of stills from the film; 95¢) and Damon Knight's 1967 anthology, "Worlds to Come" (Gold Medal Books, Greenwich, Conn.; 255 pp.; 60¢), which contains the 1951 short story in which the basic idea of the film was introduced in somewhat different form.

"The Sentinel," as the original story was called, was one of those very slight ideas that in science fiction is sometimes allowed to pop up and die without any attempt to make it carry a plot. It describes in Clarke's best documentary manner how explorers on the Moon find a crystal pyramid, protected by a force field, set there millions or billions of years before by a space-wandering race. The finders manage to smash their way through the protecting field and stop the signals it is sending out through space. And

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the story ends: "We have set off the fire alarm and have nothing to do but wait."

In the novel and the film, this thought-provoking idea is developed, expanded, and in a sense turned inside out. As a book, "2001: A Space Odyssey" makes better—or, at least, clearer—sense than the film, which Kubrick has repeatedly said has no "real" meaning, in the sense that it is intended to tease and agitate the imaginations of its audience and let them find meanings of their own. It also tries to bridge Clarke's two modes of science fiction: the documentary and the poetic, the approaches of "Prelude to Space" and "Childhood's End." It doesn't quite succeed. The film will be remembered; the book won't.

There are differences, and they are on the side of logical explanation. The pyramid of "The Sentinel" has become the gigantic black monolith of the film. Set down among the sub-men of the early Pleistocene, its radiations or telepathic influence rearrange the structure of their brains and convert apes into incipient men. This rather lengthy section is one that many viewers find boring. If the monolith had emitted a green ray or something equally tangible—and conventional—instead of showing apes becoming men, they might have been happier about it.

The second episode, in which scientists unearth another of the monoliths on the Moon, is the technical highlight of both book and film. This time, instead of being set out for the first Moon explorers to find, it is carefully buried, so that somewhat more advanced technology is required to discover it. Instead of emitting a signal like a lighthouse, that men shut off when they find it, the thing announces their discovery with a great blast of radio noise.

The third part is a totally different story, and it seems to me that this is the major shortcoming of both book and film. As you must know, it follows the crew of a spaceship tracing the signal out to the moons of Jupiter (Saturn in the book—and what a spectacle that would have made! I'm afraid I can't see why it wasn't used). The ship is actually run by "HAL," a computer designed without benefit of Asimov's three laws. The actors, except for the gentle voice of HAL, are thoroughly wooden and uninteresting, and I can't help wondering whether this isn't Kubrick's subtle way of suggesting that the computer is really more "human" than they and fully justified in trying to get rid of them before they louse up an important mission. Some day we may know whether the theme of this part is a Clarke or a Kubrick contribution. I suspect it was the latter—perhaps to give part of the picture a story, perhaps to warn us against letting machines go too far in taking over our lives, perhaps just because Stan-

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ley Kubrick is said to like gadgets. (The oscilloscope displays that flash off and on all over the control board seem to be about as functional as having the instrument panel of a jet liner plastered with textbook diagrams.)

In the final portion, after the ship has found another of the monoliths, book and film seem to head for the same goal by quite different routes. In the book, the monolith is a "gate" that transports Bowman and his pod from place to place in the universe, glimpsing the final history of the beings that set it in space, until he merges with them and returns to Earth a superman, ready to launch mankind on another cycle of development. In the film it triggers a flood of psychedelic effects which appear to do symbolically what his actual experiences and visions do in the book, but return him to Earth an embryo from which a new race of men will develop, rather than the superbeing which can shape mankind or destroy it—the ape-man of a new cycle of development.

There are rumors that the success of the film may lead to a screen version of "Childhood's End" or "Against the Fall of Night." If so, I hope the film is made by a producer/director with Kubrick's talent and imagination, but one who will let Arthur Clarke tell his own great story in his own way. It will be a better film, if not so tantalizing a one.

ANALOG 6

Edited by John W. Campbell • Doubleday and Company, Garden City, N.Y. • 1968 • 313 pp. • $4.95

These Analog anthologies are now in phase with the calendar: all the stories in this volume appeared in Analog in 1966. If you were reading the magazine then, you've read them; if you weren't, now's the time. Two of them—Bob Shaw's "Light of Other Days" and Gordon Dickson's "Call Him Lord"—are stories you'll be seeing over and over in other anthologies.

One of the fourteen selections is an article, J. E. Enever's "Giant Meteor Impact," which gives you an idea of the forces involved in making those spots you see on the Moon. (In passing, one of the stories in "Last Door to Aiya," the new anthology of Soviet science fiction — "The New Signal Station," by S. Ganovsky—comments that high-velocity machine gun bullets make a little puddle of glass in each crater they make in dry sand.)

In "Light of Other Days" a new Irish writer has invented one of the really new concepts we have had in some time—slow glass, which absorbs and releases the scenes to which it is exposed. Around this idea he weaves a simple and rather sentimental little story, but it's how he does this that makes the story memorable. The same is true, in a way, of Dickson's "Call Him Lord," in which a princeling from the stars is introduced to Earth, and Alexan-

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der Malec's "10:01 A.M.," a grimly nasty little story of future juveniles and future traffic courts which makes a bridge between Rick Raphael and the Anthony Burgess of "Clockwork Orange."

Keith Laumer's "Prototaph" is a short-short that makes a supernatural idea credible; I don't buy it as SF. Vernor Vinge, another of the newer writers, introduces us to an educated chimpanzee on the lam in "Bookworm, Run!"—and I do mean "Introduce," for Norman becomes very real. Lee Corry's "The Easy Way Out" is one of those turnabout stories that never pall when they are well done: extraterrestrials who misinterpret what they see on Earth. And Robin Scott's "Early Warning" is a lovely little technological spy story with a double twist.

Hank Dempsey has another delightful piece of entertainment in "CWACC Strikes Again," in which a pair of con-men try to swindle the Committee for Welfare, Administration and Consumer Control, an organization dedicated to giving inventors of wild-eyed impossibilities their chance to make good. "Stranglehold," by Christopher Anvil, is one of that reliable author's encounters with the outrageous people of another planet—a breed who make magic that isn't quite magic. And Piers Anthony and Frances Hall, in "The Message," put another bit of interstellar finaglement into effect.

Another "typical Analog story" might be John Berryman's "Something to Say," in which a pragmatist and a theorist demonstrate that it isn't enough to be able to talk the opposition's language—you have to have something to say to them. Stewart Robb has a choice example of literary reasoning in his "Letter from a Higher Critic," dated May 5, 2415, which demonstrates quite convincingly that the history of our times never happened. And Joseph Martino, in ". . . Not a Prison Make," shows us the teleporting guerillas—quite unbeatable, until. . .

It's one of the better Analog anthologies, and those two stories are really tops.

NEUTRON STAR

By Larry Niven. • Ballantine Books, New York • No: U-6120 • 285 pp. 75¢

These eight stories by one of the better new writers of the last few years are all laid in the twenty-sixth century, in a galaxy where Man has encountered a great variety of other races, hostile, friendly, and simply wanting to be left alone. Current problems sometimes arise from a dead but not forgotten past and sometimes are the effect of brash, young humans probing their elders' tender spots. The title story, you'll remember, won the "Hugo" as best short story of 1966.

It is one of four stories about Beowulf Shaeffer, an adventurer who undertakes various commissions for the Puppeteers and other nonhuman inhabitants of assorted

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planets. In "Neutron Star" he investigates that peculiar object and rediscovers some of the basic phenomena of physics. In "At the Core" his former clients send him to the center of the galaxy, which he discovers to be exploding. The Puppeteers immediately abandon inhabited space, leaving Be free to help a tycoon hunt for their unknown planet in "Flatlander." What he finds is something else again, but he is still going strong in "Grendel," some several years later, when he mixes into a kidnap-and-blackmail plot. Being an efficient rascal, he outblackmails the blackmailers and makes a nice profit.

All these stories employ special, practical knowledge of physics or exobiology to give their hero a slight edge over the guys in the black hats. In "Relic of the Empire," a scientist overcomes Jinxian pirates by using the weird flora of one of the planets of Mira. In "The Soft Weapon," a mad Puppeteer helps the good guys get away from some thoroughly nasty types, with the aid of an ancient weapon that outdoes 007 or Our Man Flint. "Ethics of Madness" describes the evolution of a paranoid and a chase that outdoes Javert and Valjean, and in "Handicapped" we learn a little more about the Slavers and other great ones of the deep past.

Larry Niven combines "hard" science and swashbuckling action in a way that nobody else has done in years, if ever. You should enjoy him.

NEW WRITINGS IN SF-4

Edited by John Carnell • Bantam Books, New York • No. F-3763 • 154 pp. • 50¢

John "Ted" Carnell, who formerly edited and published the leading English SF magazine, *New Worlds*, doesn't call these periodical anthologies "best" collections, though the publisher does. Some of the stories are written especially for the anthology; others come from sources that most readers won't see—Isaac Asimov's "Star Light" from the Hoffman Electronics Corporation series of SF advertisements, for example, or Dennis Etchison's "The Country of the Strong" from *Seventeen*. On the other hand, William Tenn's "Bernie the Faust," with its honorable conman and gullible (?) alien from the sticks, should be familiar to most American readers by this time.

David Stronger, in "High Eight," has a long novelette that combines what reads like practical knowledge of high-tension technology with a concept of life like something out of Hoyle's "Black Cloud" or Stapledon's "Last and First Men." Colin Kapp's "Hunger Over Sweet Waters" is another kind of technological story that would have fitted very well here in Analog—overcoming disaster on a world where there is little or no land. It's my favorite in the book, though the Etchison story is more grimly cruel and powerful —a horrible vignette of life after mutations have become common.

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Dan Morgan's "Parking Problem" is a comedy, in which a couple of fast-talking operators take over the Extra Dimensional Parking Lockers . . . until pink tricycles start coming out instead of cars. And Keith Roberts, in "Sub-Lim," quite outdoes Pohl and Kornbluth in his satire of advertising ethics. You should like 'em all.

Recent Reprints and Reissues

WE CLAIM THESE STARS
By Poul Anderson • Ace Books, New York • No. G-697 • 125 pp. • 50¢

How do you capture a telepath who can "see" you coming. A Dominic Flandry yarn.

ECHO X
By Ben Barzman • Paperback Library, N.Y. • No. 54-684 • 252 pp. • 75¢

Reissue of the pb edition of a book formerly called "Twinkle, Twinkle, Little Star"—an alternate time-track story.

THE OTHER SIDE OF THE SKY
By Arthur C. Clarke • Harbrace Paperbound Library; Harcourt, Brace & Co., New York • No. HPL-25 • 248 pp. • 75¢

Twenty-four short stories, including some famous ones such as the Hugo-winning "The Star" and "The Nine Billion Names of God." There is also a useful bibliographical note.

ADVENTURES IN TOMORROW
Edited by Kendell Foster Crossen • Belmont Books, New York • No. B75-215 • 236 pp. • 75¢

ALIEN WORLDS
Edited by Roger Elwood • Paperback Library, N.Y. • No. 53-667 • 176 pp. • 60¢

The Crossen anthology was originally published in 1951 and spans the next million years in fifteen stories. The Elwood book is a reissue of an original 1964 paperback with ten rather minor stories, including one by John Campbell.

THE REVOLVING BOY
By Gertrude Friedberg • Ace Books, N.Y. • No. H-58 • 192 pp. • 60¢

The first boy born in space grows up to be oriented toward a source somewhere deep in the galaxy.

THE PEOPLE: NO DIFFERENT FLESH
By Zenna Henderson • Avon Books, N.Y. • No. S-328 • 221 pp. • 60¢

Somehow, the stories about the People are growing a little flat.

ELEMENT 79
By Fred Hoyle • Signet Books, New York • No. P-3463 • 143 pp. • 60¢

This astronomer's science fiction and fantasy shorts are by no means up to his novels.

EARTHBLOOD
By Keith Laumer and Rosel George Brown • Berkley Books, N.Y. • No. S-1544 • 287 pp. • 75¢

A grand old-fashioned whirl through the galaxy of 13,000 A.D.

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brass tacks

Dear [illegible]

With reference to Mr. R. W. Cumm[illegible] letter in the May issue. If my memory serves . . . and it is nearly thirty years since I read the book . . . his solution to the Brain Drain was put forward by Edward Bellamy. He will find it detailed in "Looking Backward." (Page reference will depend on edition, but again, if my memory serves, it is nearer the start of the novel than the end).

With reference to your answer, and to the question of the Brain Drain in general, may I comment that it is not only scientists and other technically trained personnel who are coming to the U.S. As a Canadian, and a historian (or would be one) I also have come to the country where I can, hopefully, follow through on study in the branches of history, and studies of man's past in general, more readily than in Canada. The more easily, in fact, in that interdisciplinary work seems to be more acceptable here. (My reference for that is my own letters to the Montreal *Gazette* in 1962 at the time I was arranging to come down. I was not challenged at that time by anyone . . . nor was I, either, when I said essentially the same in a letter to *Chemistry in Canada* at about the same date, although that letter was not primarily concerned with my own field of interest.)

My conversations with other expatriated students and others have, over the years, confirmed my feeling that many of us give our loyalty to a discipline and to that degree, perhaps resemble the wandering students of the later medieval period: we go where we can study most effectively. Which, today, is the U.S. and its universities and research foundations.

WILLIAM B. WHITHAM
158 Brainard Road,
Thompsonville, Connecticut 06082

The "brain drain" is anything but new! History is full of it back to the early Greeks and Egyptians.

Dear Mr. Campbell:

I would like to take issue with Ben Bova in the June article "It's Right Over Your Nose." He states

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that by traveling at 99.9 of light speed, coupled with suspended animation, it would be possible to explore most of our universe within a human lifetime. Maybe the problem lies in our respective definitions of "explore." If we are really exploring, we had better slow down enough to see something. Even if we ignore the time lost in slowing down and re-accelerating from the systems visited, and pre-suppose a small hyper-efficient survey ship launched from the interstellar vessel, we are in trouble. It will take some finite amount of age inducing normal time to take a proper look around. It becomes clear that even spending one day per likely-type system means a mere 36,500 visits if the explorer lived to be one hundred years old.

Of course, if quasars are produced by thousands of alien star ships, I'm sure it would be of no small interest to look at their economic system. Postulating that "what's true for us is true for them," they have a lot of sub-light ships cruising about for several thousand subjective years at the various home planets. The merchants or governments who sponsor such ships must have the patience of the sphinxes, or supreme faith in the durability of their cultures to launch missions which may not return for twenty generations.

Because I happen to like the "hyperspace" theory, I propose an alternate solution to the quasars. No matter how fast a plane traverses the atmosphere, the sound of its passage lopes along at steady old Mach 1. If a friendly time warp allowed a flight of F-4c Phantoms moving at Mach 2, to pass over a group of circa 1900 scientists, would they deduce that supersonic aircraft had produced the frightening phenomenon they just experienced? Maybe quasars are the visible sub-light evidence of the passage of a ship in hyperdrive, sort of a cosmic wake turbulence.

(Lt.) RICHARD GEIGER
Box 4741
San Francisco, California 96328

Well, you know these tourists—two weeks in ten cities and they come home experts on foreign affairs!

Dear Mr. Campbell:

Ben Bova's fascinating article, "It's Right Over Your Nose," raises a few questions.

Let's suppose that the quasars really are hollowed-out, planet-sized spaceships. Such a ship might well park for extended periods to explore a local area of space, such as a solar system, if the system contained something valuable, or something interesting, such as an emerging life form with intelligence.

Possibly, a probe should be sent to take a closer look at Pluto. Since Pluto's existence wasn't

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even suspected before the turn of the century—probably, not too long a time by the reckoning of the planet-carving explorers—we could question the length of time that it has actually been a part of our solar system.

Such a ship would, surely, have to carry smaller craft for local exploration. Assuming that there really are some UFO's that are not "swamp gas," this could be a possible explanation for their existence.

What would be the effect on the Earth, if such a ship, parked as close as—say—Pluto's orbit, should decide to fire up its engines and move on?

Could be we have already attracted "their" attention.

WALTER TRENCH

107 Wheeler Avenue,
Westwood, New Jersey 07675

Maybe our astronomers would "discover a new supernova?"

Dear Mr Campbell:

Big bravos for brave Ben Bova! His proposition—"It's *Right* Over Your Nose!" June issue—that quasars may be giant interplanetary spaceships was just nutty enough to be interesting, and just scientific enough to be convincing. In fact, the idea began to stimulate some thoughts immediately after I finished the article.

Provided that Mr. Bova's data is correct, and that his theories are plausible, we could picture a Terra-type planet, complete with civilization, zooming through space at .999*c* or whatever. The inhabitants of the planet could lead as normal a life as possible: no more difficult than our proposed lunar colonies may be, perhaps. This "planetship" would rely on itself and cosmic debris for fuel. O.K., now, does anyone have any idea as to how it would steer? Or would it be pre-aimed, and then shot to its target with hopes that the calculations won't be too far mistaken? This is my only real question, which perhaps Mr. Bova can answer.

Assuming that our planetship still exists, think of the boon it is to Galactic exploration: say that it enters an alien system (provided that said entrance would not cause a foul-up of celestial mechanics) and achieves orbit of the local star(s)—then, at its leisure, the inhabitants could launch exploratory craft, and obtain information, fuel and the local treasures, if any. Then, after a hiatus of perhaps several years, the planetship could start off again on some other mission. Not only would our explorers not become lonely, but the entire culture could be maintained, albeit in an altered state. On the other hand, perhaps our planetship is manned by the descendants of the two original pilots (!), who were placed on the vessel by a long-forgotten mother planet. Think of the civilization that would spring up on such a place!

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Of course, if quasars and X-ray sources are really such ships, they were made many years ago by some very old and very mature civilization. I say this because we are just now seeing them as being quite some distance from us. (Mr. Bova puts them as near as just inside the galaxy, which is still a heck of a walk.) So if we flag one down some time in the far future, as it approaches, what might we be inviting?

JOHN C. SHERWOOD
120 W. Hanover
Marshall, Michigan 49068
Sounds like a good story idea!

Dear John:

The mail that has resulted from my article, "How To Make A Star Trek," has been astounding. Since it is impossible for me to reply personally to every writer (when will people learn to enclose a self-addressed stamped envelope when querying?) I would appreciate it if you would convey the following information via Brass Tacks:

1. "The Star Trek Guide" is available by sending $1.00 cash or check to Desilu Studios, 780 Gower Street, Hollywood, Calif. 90038.

2. Studios will never read an unsolicited script. Aspiring writers must submit same through recognized agents because of legal factors involved. If you wish to submit a script to "Star Trek," inquire first about agents from the studios.

3. Tachyons are hypothetical particles that have speeds exceeding that of light. According to Feinberg of Columbia, tachyons should be detectable by their Cerenkov radiation in free space, and he proposed to look for such Cerenkov radiation by means of rocketsonde or satellite instrumentation. This whole matter was announced in the public press while the Star Trek article was in preparation and indicates to me that science-fiction readers probably do not trouble themselves any longer to keep current in scientific matters; it didn't used to be that way. But of course, most science fiction has now become more fiction and less science, except in Analog.

G. HARRY STINE
What Harry Stine got was only part of the response—Roddenberry and I also got a flood!

Dear Mr. Campbell:

Re: Your editorial "Secret Science" (January 1967), and other similar comments.

A Patent Tragedy

Once more, once more the pirates all,
Were hirpling in at the "lawful" call,
To steal, with help of lawyers sly,
The inventions they were too "smart" to buy.

They had precedents (twenty since last Fall),
To let them "Preserve Democracy," (their call).

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But still, their company was born
to die.
They had, I fear, a most incompe-
tent spy.
So they were left swearing and
miles behind,
They could steal the works, but
not the minds.

MARK A. SWANSON

Pomona, California 91767

Rudyard Kipling, in "The Rhyme of the Mary Gloucester" said the same thing long ago; it's one of my favorite quotations:

"They copied all they could follow,
But they couldn't follow my mind!
So I left them—sweating and steal-
ing!—
A year and a half behind!"

Dear John:

I enjoyed Mr. Sid Davies' letter about my "Horse Barbarians," but you should not berate yourself that you "missed that one," and I'll be happy to tell you why. You will remember that we went 'round and 'round about a number of points in this story. (I'm sure you will recall, with a wide grin, your pinpointing The Affair of the Misplaced Latitude.)

Firstly, Mr. Davies is "even willing to accept a rubbery vine which evidently grows in five kilometer lengths." He doesn't have to, because I wrote that there was a knot "Every hundred meters, more or less . . ." Mr. Davies writes further that ". . . it is stated that there is a knot in the middle of the ten-kilometer length required to lower the hero down the face of a cliff ten kilometers high." Sorry, still completely wrong. The only place where I give any length to the thing is when Jason dangles ". . . at the end of the kilometer-long bobbing strand . . ."

Nor is the cliff this high. The height of the cliff is first given as ". . . three to ten kilometers high . . ." and even this is qualified later when Jason observes ". . . that the point on the cliff above . . . was much lower than the rest of the stone barrier. He assumed that there was a matching rise in the ground below." With this qualification the earlier minimum figure of three kilometers reduces nearer to two, or about a mile high, which was the figure I had in mind.

Now, if we take Mr. Davies' one ounce per foot for the vine, the mile-long length weighs just three hundred thirty pounds. Since there is 1.5G on Felicity the weight becomes four-hundred forty-five pounds. Therefore, I believe it well within the realm of probability to state, as I did, that ". . . one of the men had to climb up to reseat it." If I had written that he carried a crowbar for the job there would certainly be no room for the slightest argument.

But I still must apologize to Mr. Davies for not *lying* well enough. For after all—what else is a work of fiction? There is no planet like this one, no barbarians and, sadly,

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no Jason dinAlt. Except in my mind—and now in those of the readers. I made the whole thing up! I planted the clues about the length of the vine, but not clearly enough it appears now.

A science-fiction writer cannot always get every fact right—but he owes it to his readers to try. At Analog the reader's right to enjoy a story is guarded by the editor who has a very keen eye for this sort of thing. He makes the writers Try a Bit Harder. He may have forgotten The Affair of the Misplaced Latitude. I doubt if I ever will.

HARRY HARRISON

And on a heavy world, plants and animals would naturally evolve structures of great strength—even stronger than silk, which has a higher tensile strength than steel!

Dear Mr. Campbell:

Since you're interested in homespun science observations, try this on for size.

Not long ago, I was discussing types of shampoos which my girl friend and I use. She mentioned that she uses two different kinds, alternating their use—one for two or three shampoos, then the other. Her claim: "It keeps my head cleaner." Since my own shampoo didn't seem to be doing a very good job "any more," I wondered what principle could be involved. When I first started using my present shampoo, it did much better—*i.e., left no soap scale,* et cetera. It also reminded me that the preceding shampoos I had used acted in the same way.

She told me that her deodorant worked the same way, so she uses two different brands. (*Phew!* my deodorant has "lost its power" also!!) The next day after musing on this, I asked her about tooth powder. The same effect seems to be in operation, although she merely bought a different brand occasionally.

I have started applying this theory with apparently good results. I say "apparently" because of the subjectivity of the phenomenon and the small statistical sample size.

Postulate (?) Initially the human mechanism reacts—chemically—to the foreign substance. Adaptation functions alter the chemical structure of the human mechanism and the foreign substance no longer reacts.

Perhaps this gimmick could be used by a company manufacturing such products as a sales idea. My own contacts in this area are limited so perhaps you could publish the idea and/or add it to your files on "reactions of the human body to foreign substances."

D. A. DAVIDSON
1542 Jupiter Drive
Milpitas, California 95035

Hm-m-m—suppose that's why those TV ads succeed in selling so many variations of the same basic things?

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TECHNOLOGICAL STATUS
continued from page 7

pens to inherit a few thousand dollars, or hit it lucky in gambling, promptly puts it into fancy new clothes, a down payment on a fancy new car, and a fancy new woman or two, and has himself a whee of a time being admired, and respected because man, he's got all the symbols of Status!

So in three months the fancy car is repossessed, the fancy woman moves off, and the fancy clothes prove to have poor durability.

Another approach is to spend the little inheritance on getting a small business started--maybe a neighborhood grocery, or a newsstand. Doesn't get you much Status, of course, and not much spectacular fun . . . but put to work that way a few thousand can support you for life.

It's just that it is *not* as much fun, and the few thousand won't do it unless you get in and work just as hard yourself, and that makes the whole idea much less popular.

The national equivalent now showing up among the backward nations is that foreign aid—winning the numbers game, in the international lottery!—is spent on fancy Status projects. Hydroelectric plants are Status Symbols, man! That means you've *got* it!

Even if you don't have many electric lights or power machines in grass huts and fields plowed by men and women pulling wooden stick plows through the earth.

Steel mills are great international Status Symbols, too. Of course, what would *really* make one of those nations have Status with all its neighbors would be to have something really technical and ultra-fancy, like a few nuclear bombs.

Trouble is, nobody, except a few experts, in a few major western nations, have the wisdom to see that the horse collar is one of the greatest technical developments of human history.

The basic plot in Christopher Anvil's "Royal Road" stemmed from an actual disaster of WWII; it didn't have the comfortable ending Anvil's story did. The lesson, bitterly learned then, is being relearned most reluctantly by the backward countries today.

The allies had a tremendous military need for roads and barracks and airfields in an area where there simply were none. It was a remote area; shipping simply wasn't to be had for sending in earth-moving machinery, bulldozers, power shovels and so on. So local natives were hired, at high pay, to do the work.

The men who set up that operation didn't know what a subsistence-level economy was; they found out that fall and winter. The men they'd hired to work at such fine wages were, of course, the native farmers—who therefore didn't farm that year.

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In Anvil's story, the thing was planned, and the aftermath was part of the plan; in the real event it wasn't planned that way—it just happened. There was no shipping to bring in food that winter, just as there had been no shipping to bring in earth-moving machinery. It was a horribly grim demonstration of the oft-repeated remark of philosophers that "you can't eat gold." There was a lot of money around—but no crops.

What's happening again and again in backward countries today is of the same order. The magnificent new dams and hydroelectric plants employ thousands of workers at good wages—and hire them away from food-production in a near-subsistence economy. The result is inadequate food production, incipient famine, and a desperate plea for help to feed the starving millions. But they sure have a great Status dam!

Oh, they get irrigation water, too—only sometimes the results haven't been any better thought out than the economic disaster of famine was. Many areas of the world have fairly fertile land lying on top of extremely saline under-soil—practically salt beds. When rain falls, the fresh water seeps downward, and keeps washing the salt back down to the under-soil where it is harmless. But run in irrigation water—the salt from below dissolves, and evaporation from the surface soil pulls the now-saline water up, where it in turn evaporates, and thus rapidly builds up a salt crust on the surface.

It takes several years of non-irrigation, and no crops, for natural rainfall to wash the salt back down so the land can be used again.

But don't you forget—that big irrigation dam and project is an international Status Symbol of high value!

If a nation has a primitive subsistence-level economy, this simply means that its food-and-goods production has economic value just barely sufficient to keep the population from starvation. And that in crop-failure years, there will be famine, and people will die of starvation.

In many, many such subsistence-level areas, if such famines occurred, there was literally nothing whatever anyone could do to help them. The thing happened repeatedly in India and in China; India, under the British, had railways and His Majesty's Government did everything humanly possible to relieve the starvation. But the food needed to feed 300,000,000 starving people can't be gathered from the surrounding areas; they're subsistence-level economies, too. And the railroads weren't vast, heavy-traffic networks such as Europe and America had developed; they didn't have enough cars or engines. And shipping from half around the world took so long that even if the transport and grain were freely donated,

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it wouldn't get there in time to be very helpful.

In China, because of bad roads and no railroads at the time, there were huge areas where the *only* possible transport was by porters. (Mules can't climb ladders, and some of the routes required ladders to get up mountain "passes".) Since porters had to start in carrying their own food for the round trip, it was fairly easy to figure what distance of penetration was possible before the porter had consumed his total load in his own round-trip supply. No food whatever could be shipped in to any more distant point. People in those inner areas simply starved to death because help was physically impossible.

In subsistence-level economy areas today, what sort of help can the industrial nations give?

Well, first is the fact that Step #1 is to break down the cultural pattern of the people that holds them at the subsistence level. And at this step, naturally, the people will do all they can to destroy the vile invaders who are seeking to destroy their Way of Life, which is the Good, the True and the Beautiful and Holy Way.

You can't do it by telling them that they *should* stop growing those inefficient crops, those crops that produce protein malnutrition, and learn how to raise these new and far more efficient nutritive crops.

There are problems involved that aren't economic nor technical. The Israeli, for instance, have worked out techniques for growing watermelons, wheat, various fruits and grains on sandy gravel irrigated with salt water. They can make the barren Negev Desert produce fine crops of excellent food—techniques that can be applied anywhere there are sand dunes, gravel, and sea water, or salt-water springs. It would work fine in huge areas of the Sahara. No vast irrigation dams needed for this project!

Unfortunately, the Arabs don't seem enthusiastic about accepting and applying this Jewish technique.

Even if it were an Arab development, the peoples of the area are tradition-oriented; it would take at least a generation to put over the idea of doing precisely those things which they *know* are wrong. For every farmer knows that salt water kills plants, and you can't grow plants in sand and stony gravel.

The odd thing is that the salt-water irrigation can *not* be used in "good soil"; it works only in the worst kind of gravel-sand soil.

The proper development of the backward areas requires recognition that *the people don't want to change.* They want their results to change—they want to *have* the fine things other nations have, but not *to build them.*

To pull up from a subsistence-level economy, the first step is building better roads, and a more efficient agriculture. *Not* irrigation

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projects, *not* tractor manufacturing plants and hydroelectric projects and establishing an internationally known air line, complete with twenty or so Boeing 707 jets. Man, those are real Status Symbols!

What's needed is the Horse Collar Revolution and its results. Draft animals can live off the local fields; they don't require exchanging scarce goods for foreign fuel supplies and replacement parts.

The road network has to be built up slowly; too many farmers diverted to vast construction projects and you have famine.

You need schools—schools that teach agriculture and medicine and veterinary medicine and simple local-irrigation techniques and public hygiene and basic nutrition. *Not* electronics, industrial chemistry and jet-engine maintenance—not for a generation will that be valid. The few natives who are really cut out for that sort of work can be taught in other nations, where schools of that order are needed, and already exist. But don't expect them to come home—there will be nothing for them to come home to for a generation.

But no High Status schools?

Sorry—getting out of a subsistence system can't be achieved on Status—it has to be achieved by *Status*, the hard-work-and-practical-learning kind of real accomplishment.

The ancient truth prevails: God helps those who help themselves. Because even God can't help someone who won't help himself—that's what the ancient concept of Free Will implies!

The more developed nations can help effectively only where the national leaders have the wisdom to work for *real* accomplishment, not for high Status projects.

And be it noted—that "more developed nations" does *not* mean the U.S., the U.S.S.R. and other Western nations alone, by any means. One example has been cited; Israel has a technique that could immensely aid many backward nations right now.

The Philippines have developed a spectacularly productive new breed of rice by careful botanical research; they've done a bang-up job of it, and have a strain that yields three to four times as much food from a given area. It's a breed that could release two out of three rice-farmers in a subsistence-level nation to work on those needed roads and dams and other projects, without bringing starvation to the country.

The water buffalo is an extremely economic animal; it's one beastie that the western world needs to accept and use as a domestic animal —and is needed far more widely in the world. The water buffalo yields high-quality milk, high-quality meat, and is an enormously powerful draft animal capable of working under muddy conditions which ruin the feet of most creatures. Moreover, the critter can

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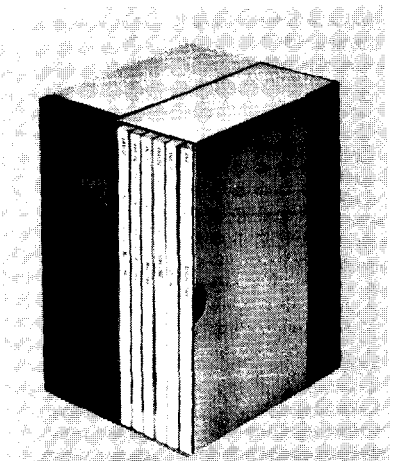
yield meat, milk, and power when fed on an incredible diet consisting solely of rice stubble! The Thais have carried on a careful program of breeding for some decades, and now have breeds of water buffalo that run over a ton in weight.

Rather surprisingly, about the only area outside of the southeast Asia region where water buffaloes are used in any numbers is in Italy, where some 40,000 of them are kept. The familiar Mozzarella Italian cheese—in its original, genuine form—is made from water-buffalo milk.

Only when many thousands, or millions, of agricultural workers can leave the farms for work without producing the inevitable famine—only when the agricultural economy gets above the subsistence level—can any nation become "advanced." Argentina isn't an industrial power—but has a highly developed agricultural economy. All of the highly industrialized nations *first* became highly successful agricultural nations.

Yet we—and unfortunately the backward nations!—see the horse-drawn plow and the farmer as symbols of low-status, non-industrial economies.

The great trouble is that *people don't want to change*. It's not *just* the peoples in backward countries; the great economic advantages of the water buffalo have been around for centuries, yet only Italy among all the western nations has accepted them. Why aren't they being raised in southern Louisiana, for instance, where there's plenty of land and climate of the type they particularly love?



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In Africa, millions of children die of protein malnutrition because the natives raise traditional crops that do not provide the essential amino acids—and can't be induced to change their customs.

Indians in Central America suffered the same type of protein malnutrition; their one and only staple was corn—maize. And corn, like most grains, is deficient in lysine to

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an extent human beings can't live on it.

Anthropologists and nutritionists could get nowhere changing their dietary habits; finally botanists succeeded in breeding a strain of corn that did contain adequate lysine, so the natives could go on doing as they'd always done—eating corn—and still get the food they needed to live.

That is not a solution to the problem.

Sure, it keeps the children alive—but it does not achieve the crucially important necessity. Those people will remain forever backward people unless *they* change.

A change in government does no good, for a government cannot remain in power if the people actively hate it. And so long as people insist on not changing their Good, Beautiful, Familiar and Holy Traditional Way of Life—even if it's killing them!—the social system will not change. And they'll kill anyone, any government, that seeks to change them, if they possibly can. Only a powerfully entrenched and ruthlessly determined dictatorship can impose on them the basic changes they, the people, must make.

If, that is, you insist the change must be made in this generation.

Otherwise, you'll have to have patience, and wait while slow, steady, continuing pressures alter the Established Way of Things decade by decade.

And the greatest, fastest progress will be made in the backward nations which gain least Technological Industrial Status Projects—and develop their agriculture most.

In a rice-eating nation, if one third of the rice-growers, raising high-production strains, using new and more efficient techniques, can sell twice as much rice for only seventy-five percent of the cost—the rice-farmer who would not change his traditional ways will be forced out of agriculture. His poor harvest won't be wanted. He'll lose his land, his home, all the things he has lived by and with.

Here, the ruthless dictator who forces him to change his way of life is not human—it's economic. It's even more ruthless and relentless. But it, too, has the same compelling message: "You *must* learn a new way of life—or die!"

At the same time, of course, the fine surplus of cheap rice means that industrial workers, road and dam builders, all sorts of people in all sorts of newly developing occupations, are living much better. The old near-starvation level of rice is gone—there's plenty to eat, at last.

Look, friends—industry didn't produce a high standard of living. A high standard of agriculture forced people to learn a new high standard of living and industry.

And that's the only way it will be—unless a completely ruthless, dedicated tyrant oppresses his helpless people into learning the new way of life *fast.* ■ The Editor.

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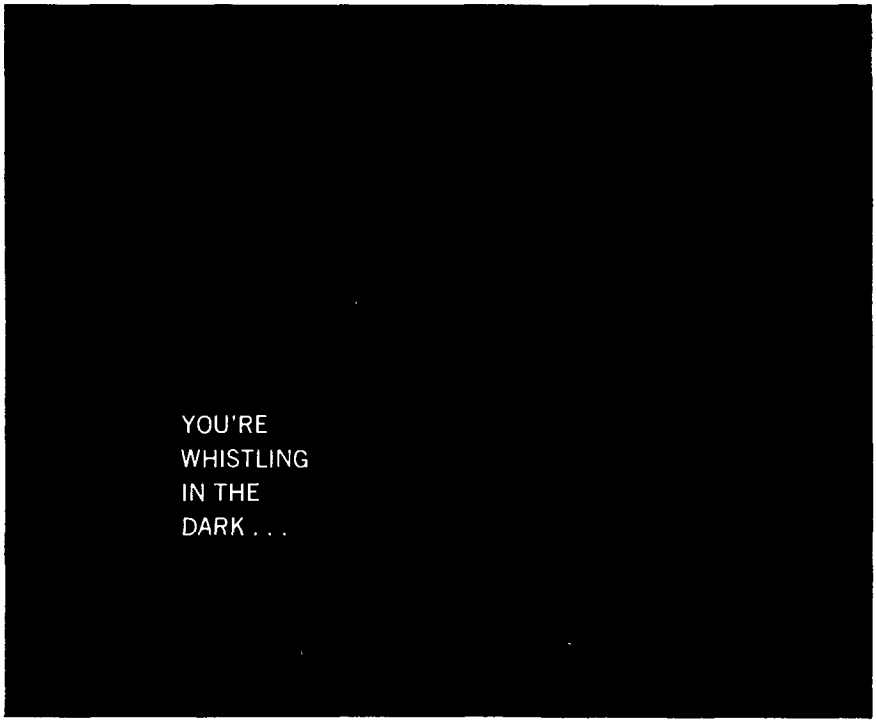

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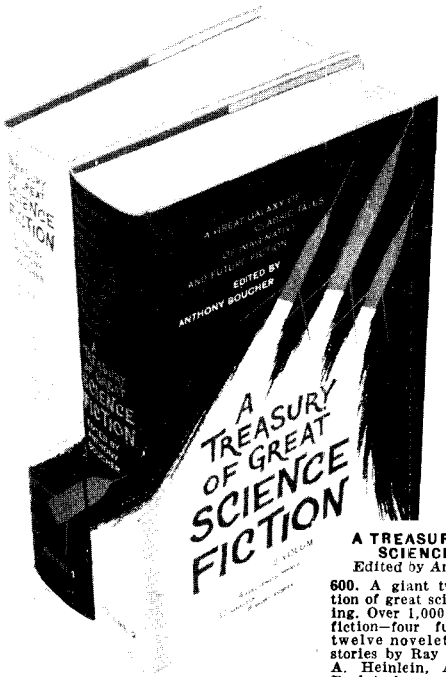

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